Bromatology of forage and haylage from different oats harvested at pre-flowering stage in Guarapuava-PR

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Introduction The winter cereals allow the grazing, as well as the production of haylage, which is used as a food option throughout the year (Bumbieris Jr. et al, 2011). The process of winter forage dehydration before silage helps in the lactic:acetic acid relation, reduction of ammonia production, restriction of butyric acid production, among other factors that culminate in a more efficient fermentation (Berto and Muhlback, 1997). Among the several winter cereals, there is the oat (*Avena* spp.), which is widely used during winter periods. The use of these cereals in pre-flowering stage reflects in higher crude protein content if compared with the other stages (Floss et al, 2007). Therefore, the objective of this work was to bromatologically evaluate the different types of oat in the form of forage and haylage with their cuts in the pre-flowering phase.

Materials and Methods The experiment was carried out at the Agrarian and Environmental Sciences Department of University of the Midwest (UNICENTRO), on the premises of the Animal Production Center (NUPRAN), in the municipality of Guarapuava – PR. As experimental material, it was used black oat (*Avena strigosa)* cv. EMB 139 and cv. IAPAR 61; white oat *(Avena sativa)* cv. IPR 123 and cv. URS Taura. Sowing was performed with 0.17 m inter-row spacing, mean sowing depth of 2 cm and sowing density of 300 seeds per m². Manual cutting was performed at a pre-flowering stage, 10 cm from the soil. The determination of dry matter content (DM) was performed in a forced air oven set at 55°C until constant weight was obtained. The pre-dried samples were ground in "Willey" mill, with 1 mm sieve, wherein the crude protein was then determined (CP), by the micro Kjedahl method, and mineral matter, acid detergent fiber (ADF) and neutral detergent fiber (NDF), according to Silva and Queiroz (2009). The same was done with the samples of haylage. After the cut, the oats were pre-wilted in the field until reaching DM content close to 64.1%, chopped in stationary forage, with average particle size of 10 mm, ensiled in PVC silos with 40 cm of height and 10 cm of diameter. The experimental design was a randomized block design, composed by four treatments and four replicates. The obtained data were submitted to the F test at 5% probability of confidence, through analysis of variance (ANOVA) and then the Tukey test for comparison of multiple means at 5% of significance, through the SAS program (1993).

Results and Discussion There were differences when comparing forage and haylage hears ($P<0.05$) for the levels of DM and ADF (Table 1). The DM% differences are due to the fact that the haylage undergoes a field dehydration process prior to silage. On the other hand, the increase of the ADF can be explained by transformations of soluble carbohydrates in organic acids during the fermentation process (Pereira and Reis, 2001).

Table 1 Chemical-bromatological composition of forage and haylage from different oats harvested at pre-flowering stage.

Species	Black oat		White oat		Average
Cultivar	EMB 139	IAPAR 61	IPR 126	URS Taura	
	Dry Matter, %				
Forage	21.1 a	23.4 a	24.3 a	18.5 a	21.9 B
Haylage	51.2 a	62.5 a	61.3 a	53.8 a	57.2 A
	Ashes, % of DM				
Forage	5.87 a	5.73 a	5.57 a	5.62 a	5.70 A
Haylage	5.36 a	4.89 a	4.91 a	5.41 a	5.14 A
	Crude Protein, % of DM				
Forage	9.28 a	8.06 b	8.85ab	9.96 a	9.04 A
Haylage	9.18ab	7.41 c	8.29 b	10.10 a	8.75 A
	Neutral Detergent Fiber, % of DM				
Forage	74.09 a	72.09 a	70.97ab	66.85 b	71.00 A
Haylage	71.69 a	71.26 a	72.03 a	69.62 a	71.15 A
	Acid Detergent Fiber, % of DM				
Forage	46.82 a	45.90 a	44.89 a	38.69 b	44.08 B
Haylage	47.99 a	46.13 a	47.22 a	42.05 b	45.85 A

Averages, followed by different lowercase letters in the row, differ from each other by the Tukey test at 5%.
Averages, followed by different uppercase letters in the column, differ from each other by the F test at 5%.

Among the cultivars there were differences ($P<0.05$) in PB and ADF for both forage and haylage, and differences ($P<0.05$) in NDF only for forage. The white oat URS Taura showed 24.5% and 36.3% CP higher for forage and silage respectively, when compared to the black oat-IAPAR 61 that presented the lowest results. The white oat URS Taura also showed the lowest fiber values, with 9.8% less NDF and 17.4% less ADF for forage and 12.5% less ADF for haylage, when compared to the black oat EMB 139 that presented the highest values. It is known that higher values of NDF of the roughage end up limiting the consumption by the animal, as well as the ADF limits the digestibility (Van Soest, 1994).

Conclusions Among the evaluated forages, the white oat – URS Taura presented the best results for CP, NDF and ADF content, being the most recommended for both forage and haylage.