

Chemical composition of forage and haylage of winter cereals in Guarapuava-PR

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Introduction Winter crops are used in the southern region of Brazil to maximize land use, as an alternative to cattle feed, using them as grazing and the surplus can be used to produce haylage, having stored food for other times of the year (Bumbieris Jr. et al., 2011). Harvesting in the pre-flowering stage of temperate forages with high levels of crude protein and fiber digestibility, but the material has low dry matter, requiring pre-drying before ensiling (Borreani et al., 2007). The chemical composition of different winter cereals (barley, wheat, rye, triticale), as forage and haylage, was evaluated considering the importance of these aspects in the nutritional quality of the food to ruminants.

Materials and methods The experiment was conducted at the Núcleo de Produção Animal (NUPRAN) of the University of the Midwest (UNICENTRO) in Guarapuava - PR. The treatments consisted of five winter cereals: barley (*Hordeum vulgare* cv. BRS Brau), wheat (*Triticum aestivum* cv. BRS Umbu), rye (*Secale cereale* cv. Temprano), and triticale (*X Triticosecale* cv. IPR 111). Harvesting was performed when the plants reached a pre-flowering stage, according to the scale of Feeks and Large (1954), and was dried up in the field until reaching ideal dry matter (DM) contents for ensiling in PVC silos. After forage cutting and after opening the silos, samples of 0.500 kg of each material were taken out to determine dry matter content through a forced air oven set at 55°C, where the samples remained until obtaining constant weight. Then the pre-dried samples of the original material were milled to 1 mm in Willey mill. In the pre-dried samples, the crude protein (CP) was determined by micro Kjeldahl method and mineral matter (MM) by incineration at 550°C (for 4 hours). The levels of neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined as described by Silva and Queiroz (2009). Data were submitted to the Tukey test at 5% significance level.

Results and discussion Haylage had 67.02% of DM mean compared to 25.84% of forage DM mean, regardless the cereals. These results were expected and necessary to avoid secondary fermentations in the silo. Among forages, triticale presented chemical characteristics that were notorious in relation to the other treatments, with the highest CP (11.37%), and the lowest NDF and ADF levels (65.79 and 38.09%, respectively), while barley and rye presented lower CP levels (8.87 and 8.48%), respectively. Some factors, as chemical composition, number of tillers per plant, and maturity stage, could be related to justify these results (Queiroz et al, 2000). Moreover, advanced phenological stage and the greater number of tillers increase cell wall components and imply in crude protein reduction (Paciullo et al, 2007). For haylage chemical composition, triticale was the material that stood out at the protein level (10.55%), considered as median, according to results obtained by other authors. Barley and triticale, in the other hand, presented ADF within the recommended level to avoid intake reduction. Meinerz et al. (2011) suggest that values higher than 40% can reduce intake. Regarding MM, haylage content was

expected to be higher than forage, due to the losses of organic compounds during fermentation, process observed for rye and triticale.

Table 1 Chemical composition of forage and haylage of different winter cereals harvested in pre-flowering stage

Species	Forage	Haylage
	Dry Matter, %	
Barley	24.78 ^b	63.09 ^b
Wheat	26.78 ^b	71.52 ^a
Rye	32.38 ^a	72.93 ^a
Triticale	19.43 ^c	60.54 ^b
Average	25.84 ^b	67.02 ^a
	Ash, % of DM	
Barley	4.66 ^{ab}	4.21 ^c
Wheat	4.31 ^b	4.30 ^c
Rye	4.72 ^{ab}	5.19 ^b
Triticale	5.22 ^a	6.64 ^a
Average	4.73 ^a	5.09 ^a
	Crude protein, % of DM	
Barley	8.87 ^c	8.26 ^c
Wheat	9.46 ^b	9.28 ^b
Rye	8.48 ^c	9.09 ^b
Triticale	11.37 ^a	10.55 ^a
Average	9.55 ^a	9.30 ^a
	Neutral detergent fiber, % of DM	
Barley	70.56 ^a	71.50 ^a
Wheat	70.06 ^a	71.98 ^a
Rye	69.57 ^a	73.93 ^a
Triticale	65.79 ^b	66.08 ^b
Average	69.00 ^a	70.87 ^a
	Acid detergent fiber, % of DM	
Barley	39.20 ^b	39.56 ^b
Wheat	41.42 ^{ab}	42.32 ^b
Rye	43.90 ^a	45.95 ^a
Triticale	38.09 ^b	39.91 ^b
Average	40.65 ^a	41.94 ^a

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

Conclusions Triticale shown the greater nutritional quality as forage, and maintained these characteristics after drying and ensiling.