by diet based on hay or maize silage

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RIASSUNTO: Influenza della dieta a base di fieno o di silomais sulle caratteristiche della carne bovina. *Il presente lavoro si propone di studiare l'effetto del fieno e dell'insilato di mais sulla qualità della carne proveniente da vitelloni di razza Charolaise. Sono stati ingrassati 20 soggetti (10 per dieta) e sono state valutate le principali performances in vita e qualitative della carcassa e della carne. L'utilizzo del silomais ha comportato incrementi giornalieri significativamente superiori (1,094 vs. 0,861 kg) e quindi pesi di fine prova più elevati (723,7 vs. 681,3 kg). La composizione chimica della carne presenta una maggiore quantità di acqua negli animali alimentati a fieno, per i quali il panel test ha evidenziato anche una minore resistenza alla masticazione. L'utilizzo del silomais nel periodo di ingrasso e finissaggio ha migliorato le performance in vita senza comportare effetti negativi sulla qualità della carne.*

Key words: beef meat, maize silage, meat quality, panel test.

INTRODUCTION – The maize silage is widely used in diet of beef cattle, particularly in areas where the maize culture is highly productive. With this cereal it is possible to reduce the feeding costs and to intensify the animal production. Nevertheless in our countries it is thought that maize silage in beef feeding don't permit to obtain meat of high quality and so, some rules for Italian young bulls production prohibit its employment (e.g. Vitellone Bianco dell'Appennino Centrale). However, the scientific literature never highlighted negative effects of maize silage on meat quality of important Italian beef breeds, such as Piedmont and Chianina (Tartari *et al.*, 1990; Russo *et al.*, 2003). In this work the effects of the employment of maize silage on quantitative and qualitative performance of Charolaise young bulls are studied.

MATERIAL AND METHODS – Twenty Charolaise young bulls were reared in the same conditions and fed two different diets (10 subjects per diet) during the fattening period (about 6 months beyond 500 kg l.w.). Diets were isonitrogenic and contained, as forage, hay or maize silage (table 1). Individual weights were recorded at start of the trial and at slaughter, while feed intake of each group was recorded daily. At slaughter, carcass was weighted and pH of *Longissimus thoracis et lomborum* (*L.t.l.*) was measured. The same determinations were repeated the subsequent day. Portion of *L.t.l.* was sampled from the loin at level of 6th and 7th vertebra. Muscle sample was maintained in vacuum for 10 days at 2-4°C. On *L.t.l.* sample the following determinations were carried out: - colour parameters L*, a* and b* measured with a Minolta Chromameter CR-200; - moisture, by lyophilising until constant weight; - intramuscular fat (IMF), as ether extract in a Soxhlet apparatus (AOAC, 1990) on lyophilised sample; - water-holding capacity according the following techniques (ASPA, 1996): drip loss on slices of 50 g placed horizontally on a grid for 24 hours at 4°C; cooking loss in oven and in water-bath; free water with filter paper press method, a modification of the method proposed by Grau and Hamm (1952); - shear force by Warner-Bratzler Instron 1011 apparatus (WB), on cylindrical cores of 2.54 cm of diameter. Moreover, samples of grilled meat were submitted to organoleptic assay by ten panellists which valuated four properties of meat on a 0-100 points scale. Data were analysed with the following linear model (SAS, 1996): $Y_{ik} = \mu + D_i + b*X_{ik} + e_{ik}$, where Y_{ik} is the kth observation of type of diets (i=1,2), μ is the overall mean, the b term is the regression coefficient on initial weight or car-

cass weight (X), and e_{ik} is the random error. For organoleptic traits also the judge effect was inserted in the model.

Table 1. Composition of diets.

		Diet	
		Silage	Hay
Ingredients:			
Maize silage	%	56	-
Hay	%	-	48
Barley	%	12	25
Maize	%	9	22
Soybean meal	%	9	5
Straw	%	14	-
Chemical composition (on d.m.):			
Crude protein	%	12.78	12.57
Ether extract	%	2.32	2.38
NDF	%	52.31	49.31
ADF	%	27.39	22.39
ADL	%	4.32	3.73
Ash	%	5.41	4.89
Meat F.U.*/kg D.M.		0.85	0.85
Avg. dry matter ingested	kg/d	10.9	11.1

RESULTS AND CONCLUSION – Initial live weight was slightly higher in Silage than in Hay diet, but difference was not significant. Silage determined higher ADG than Hay and so slaughter weight and carcass weight were lower in the latter diet (table 2). However, no differences were found for cooling loss, dressing percentage and pH values.

Table 2. Performance in vita and carcass traits (estimated at 526.56 kg of initial weight).

		Silage	Hay	Sign.	Rsd
Initial weight	kg	539.50	519.00	n.s.	30.050
Slaughter weight	kg	723.74	681.26	.04	40.879
ADG	kg	1.094	0.861	.01	0.180
Carcass weight	kg	449.03	417.45	.04	30.269
Cooling loss	%	1.19	1.28	n.s.	0.151
Dressing yield	%	61.29	60.24	n.s.	1.271
pH(1 h)		6.58	6.61	n.s.	0.207
pH(24 h)		5.69	5.64	n.s.	0.118

As chemical composition of meat is concerned (table 3), Hay diet determined higher moisture than Silage, according with the results obtained by Tartari *et al.* (1990) on Piedmontese young bull. However, intramuscular and protein contents were not different between diets.

Table 3. Chemical traits of *Longissimus thoracis et lumborum* (estimated at 438.38 kg of carcass weight).

		Silage	Hay	Sign.	Rsd
Moisture	%	74.31	75.21	.04	0.634
Protein	%	21.79	21.49	n.s.	0.435
Intramuscolar fat	%	2.79	2.20	n.s.	0.606
Ash	%	1.11	1.10	n.s.	0.051

In table 4, physical traits of meat are shown. No differences were detected for colour parameters, water holding capacity and toughness. Russo *et al.* (2003), on the contrary, found higher L* and hue values and lower drip loss in meat of Chianina young bulls fed maize silage than in those fed hay.

Table 4. Physical traits of *Longissimus thoracis et lumborum* (estimated at 438.38 kg of carcass weight).

			Silage	Hay	Sign.	Rsd
Colour:	L*		44.85	43.71	n.s.	2.518
	Chroma		23.38	25.97	n.s.	2.718
	Hue		0.501	0.477	n.s.	0.033
Water-holding capacity:						
Drip loss		%	1.50	1.78	n.s.	2.022
Cooking loss (water-bath)		%	25.11	25.83	n.s.	3.780
Free water (pressure)		cm^2	15.07	14.70	n.s.	1.581
Shear force:						
On raw meat		kg	9.62	7.63	n.s.	1.816
On cooked meat (water-bath)		kg	8.87	8.67	n.s.	1.469

Judgement of palatability of meat, conducted as panel test (table 5), showed greater mastication resistance for Silage than Hay diet but no significant differences were found in the other assay parameters, even if hay diet showed the best absolute values.

Table 5. Sensorial characteristics.

	Silage	Hay	Sign.	Rsd
Mastication resistance	39.68	33.70	.001	10.51
Juiciness	45.48	48.55	n.s.	12.29
Intensity of the aroma	45.27	48.72	n.s.	12.45
Pleasure	50.65	54.24	n.s.	12.57

The limited advantages in the organoleptic properties of meat obtained using Hay in respect to Silage diet do not seem to justify the exclusion of maize silage in the diets for young bulls, considering its ability to furnish better in vita performance with low productive costs.

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REFERENCES – **A.O.A.C.**, 1990. Official methods of analysis of the association of official analytical chemist. 15th ed. n. 960.39, Ed. Ass. Off. Analyt. Chemists, Washington. **ASPA**, 1996. Metodiche per la determinazione delle caratteristiche qualitative della carne. Università degli Studi di Perugia. Commissione di studio valutazione della produzione quanti-qualitativa della carne. **Grau**, R., Hamm, R., 1952. Eine einfache Methode zur Bestimmung der Wasserbinding im Fleich. Fleischwirtschaft 4, 295-297. **Russo**, C., Fronte, B., Preziuso, G., 2003. Uso dell'insilato di mais nell'alimentazione di vitelloni di razza Chinina: qualità della carne. Taurus 13:67-74. **Tartari**, E., Benatti, G., Barge, M.T., Destefanis, G., Zoccarato, I., Lazzaroni, C., Brugiapaglia, A., 1990. Influenza dell'alimentazione sulle performance del bovino Piemontese. Agricoltura 209-210; 57-82.