INFLUENCE OF CUTTING AND SEASON ON THE FATTY ACID COMPOSITION OF FORAGE CROPS FOR GRAZING FORAGE BEEF PRODUCTION

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Key Word : Fatty acid, alfalfa, winter pastures, cutting, season

Introduction

Little information is available about the effect of the nature of pasture lipids on beef lipids. Unsaturated fatty acids, particularly n-3 polyunsaturated fatty acids (PUFA) and conjugated linoleic acid (CLA), may be beneficial to human health. Milk and meat are the only significant source of CLA in the human diet and this appears to be related to the consumption by ruminant of fresh pastures (Elgersma et al, 2003). Sources of variation in forage lipid concentration are plant species, growth stage, temperature and light intensity. Fresh forage contains a high proportion (50-75%) of its total fatty acid content in the form of n-3 linolenic acid. Levels of linolenic acid vary with plant factors such as stage of maturity and with light treatment. Fatty acid profiles are distinctive to particular species, which confirm that fatty acid composition of forages is under considerable genetic control (Dewhurst et al., 2001). This offers the potential to select for forages with higher concentrations or altered types of fatty acids.

The objective of the research described in this paper was to evaluate the range of fatty acid concentrations considering various forage crops, at different cutting dates and seasons, used in forage grazing beef production in Argentina.

Materials and methods

Forty five (45) representative samples of three different alfalfa (*Medicago sativa*) cultivars from 3 different dormancy groups (G4-5, G6-7 and G8-9), were obtained during spring, summer and fall (5 sub samples for each season) and 54 samples of 6 cultivars of annual forage crops: Rye grass Bill (RGB), rye grass Florida RGF), wheat Charrua WC, wheat Guapo (WG), triticale Don Santiago (TDS) and Centeno Quehue (CQ). Five samples from each of these annual forage crops were cut at the end of the winter (first growth) and one month later (first regrowth). Forage samples were dried at 60°C for 24 hs and ground through a mill and five grams of ground material of each sample were used for fat extraction and fatty acid analysis. The ether extract (EE) was determined in an aliquot sample of 2 g of the ground sample with boiling hexane in a Tekator equipment according to official methods (AOAC, 1992). Other aliquot sample was extracted according to Folch, Lees and Stanley (1957). Fatty acid methyl esters (FAME) were analysed as described (Garcia et al., 2005). Analytic results were expressed as percentages of total fatty acids. The content of fatty acid was calculated on the basis of the EE and the fatty acid profile the. Statistical analyses were performed using SAS software version 6.1 1996, SPSS Inc.

Results and discussion

Season affected EE% and fatty acid composition of alfalfa cultivars (Table 1). No interactions were detected between dormancy group and season ($p<0.344$). During the fall C18:2 increased and C16:0, C16:1, C18:0 decreased. Differences between spring and summer were observed for C16:1, C18:0, C18:2 and C18:3. The EE% and contribution of C18:2 and C18:3 were higher in fall as compared with the other seasons.

Table 1. Fatty acid composition (%), ether extract (EE) and mg/g EE of C18:2 and C18:3 of alfalfa according to season.

Season	C16:0	C16:1	C18:0	C18:1	C18:2	18:3	EE%	18:3 mg	18:2 mg
Spring	29.4b	2.4c	5.6b	6.8	16.1a	39.4b	2.0a	0.80a	0.33a
Summer	31.0b	1.8b	6.6c	6.9	18.9b	33.9a	2.2a	0.75a	0.41b
Fall	20.0a	1.5a	3.2a	7.6	27.4c	40.8b	3.3b	1.33b	0.89c
SE	0.80	0.09	0.22	0.61	0.66	1.05	0.07	0.04	0.02

a b c Means in the same column with different letters differ ($p<0.05$)

The fatty acid composition, EE% and contribution (g/100g DM) of C18:2 and C18:3 of several annual forage crops are shown in Tables 2 and 3. Cutting date has affected significantly the fatty acid composition, the EE% and the contribution (g/100g DM) of C18:2 and C18:3.

Table 2. Fatty acid composition and EE (g/kg DM) of several annual forage crops

	C16:0	C16:1	C18:0	C18:1	C18:2	18:3	EE
RGB Cut 1 Cut 2	18.7c 23.8ab	2.0b 1.9bc	2.5c 4.4ab	4.5B 5.6B	10.0 b CD 11.8 a CD	62.2a 52.4bc	23.3 15.5
RGF Cut 1 Cut 2	19.6c 24.8ab	1.8bc 1.9bc	2.6c 4.5ab	4.7B 5.8B	8.5b D 10.9a D	62.6a 51.6bcd	22.7 14.9
TC Cut 1 Cut 2	21.3bc 25.8a	2.0b 1.8bc	3.3abc 4.9a	7.2AB 8.0AB	12.2b BC 12.7a BC	53.8ab 46.1bcd	22.4 15.7
TG Cut 1 Cut 2	24.7ab 25.4a	2.5a 2.0b	3.0bc 4.0abc	5.9AB 8.6 AB	12.4b AB 15.0a AB	51.6bcd 45.3bcd	23.3 16.5
TDS Cut 1 Cut 2	22.3abc 24.0ab	1.9b 1.5cd	3.5abc 3.9abc	7.3A 9.1A	12.1b AB 15.7a AB	52.8bc 45.8bcd	21.9 16.5
CQ Cut 1 Cut 2	25.4a 25.9a	1.7bcd 1.4d	4.8a 3.4abc	10.2A 8.3A	13.4b A 16.5a A	43.1d 44.3cd	21.9 16.7
Forage crop Cut Interaction	*** *** **	*** *** **	NS *** **	*** NS NS	*** *** NS	*** *** ***	

Table 3. Contribution (g/100 g DM) of C18:2 n-6 and C18:3 n-3 of several annual forage crops

	C18:2	C18:3	C18:2+ C18:3	18:3/18:2
RGB Cut 1 Cut 2	0.23b CD 0.18a CD	1.5a 0.8cd	1.7a 1.0e	6.4a 4.5bc
RGF Cut 1 Cut 2	0.19b D 0.16a D	1.4a 0.8cd	1.6ab 0.9e	6.4a 4.8b
TC Cut 1 Cut 2	0.27b BC 0.20a BC	1.2b 0.7d	1.5bc 0.9e	4.4bc 3.7bcde
TG Cut 1 Cut 2	0.29bAB 0.25a AB	1.2b 0.8d	1.5bc 1.0e	3.9bcde 3.0e
TDS Cut 1 Cut 2	0.26b AB 0.26a AB	1.2b 0.8d	1.4c 1.0e	4.4bcd 3.1de
CQ Cut 1 Cut 2	0.29b A 0.28a A	0.9c 0.7d	1.2d 1.0e	3.4cde 2.7e
Forage crop Cut Interaction	*** *** NS	*** *** *	*** *** ***	*** *** **

* p<0.05 **p<0.01 ***p<0.001

Conclusion

This preliminary study clearly shows the important changes in total lipids and fatty acid composition, particularly, in the contribution of C18:2 and C18:3, due to cultivar, cutting date and season. Considering the importance of these fatty acids as substrate for CLA and n-3 PUFA concentration in beef need, the fatty acid composition of forages need to be considered forage grazing beef production systems.

References

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