

## Fatty acid content of three grass/clover mixtures

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### Abstract

Linoleic acid (C18:2) and linolenic acid (C18:3) in feeds are the precursors of conjugated linoleic acid (CLA) in milk and meat. Moreover, the linolenic acid content in forage also increases the content of omega-3 fatty acids in these products.

In 2003 and 2004 we investigated the fatty acids of three grass/clover mixtures of the first to the third cut. Mixture A contained only grasses, mainly ryegrass and cocksfoot. In mixture B there were grasses and red clover and mixture C contained grasses, clover and alfalfa. In the different mixtures the botanical composition changed from cut to cut and from the first to the second year. The results showed that the average amount of linolenic acid (C18:3) was 64.1, 64.3 and 60.7% in the three mixtures A, B and C. The average content of linoleic acid (C18:2) was 15.4, 16.0 and 17.2% and of that palmitic acid (C16:0) 14.0, 13.8 and 14.8%, respectively. The amount of stearic (C18:0) and oleic acid (C18:1) was lower than 3%.

Keywords: grasses, clover, alfalfa, mixtures, fatty acids.

### Introduction

Forages are important sources of precursors of fatty acids, such as linolenic acid and conjugated linoleic acid (CLA), in milk and meat from ruminants.

According to Bauchart *et al.* (1984) the five major fatty acids in grass are linolenic acid (C18:3), linoleic acid (C18:2), oleic acid (C18:1), stearic acid (C18:0) and palmitic acid (C16:0). Their concentration varies depending on the plant species, growth stage, temperature and light intensity (Hawke, 1973).

Four trials were conducted at our research station in order to assess the effect of botanical composition of grass and conserved forage (hay and silage) on the chemical composition of milk, especially on the fatty acid profile of milk fat. The results with grass and hay of the second cut were published by Morel *et al.* (2005). In this paper the fatty acid concentrations within the three mixtures and different cuts are shown.

### Material and methods

Three different mixtures were sown in spring 2002. Mixture A contained only grasses: ryegrass, cocksfoot, meadow fescue and timothy. Mixture B contained the same grasses as mixture A, plus clover, especially red clover. Mixture C contained alfalfa, red clover, cocksfoot, ryegrass and timothy. In 2003 and 2004 samples were taken from the first three cuts in May, June and July. The forage of the second and third cut was about four to five weeks old. Dry matter (DM), ash, crude protein, cell wall constituents as well as fatty acids were analysed. Because only one sample per mixture of the first and third cut was analysed, no statistical analysis was carried out and only the values were compared.

### Results and discussion

In the different mixtures the botanical composition changed from cut to cut and from the first to the second year (Figure 1). In the second year, all mixtures contained also some herbs. In mixture A and B the proportion of ryegrass decreased and the proportion of cocksfoot increased in 2004 in comparison to 2003. In mixture B the proportion of red clover increased from cut to cut, mainly in the second year. Due to the drought in the first year, alfalfa developed very well in mixture C and also in the second year its proportion varied between 55 and 63%.

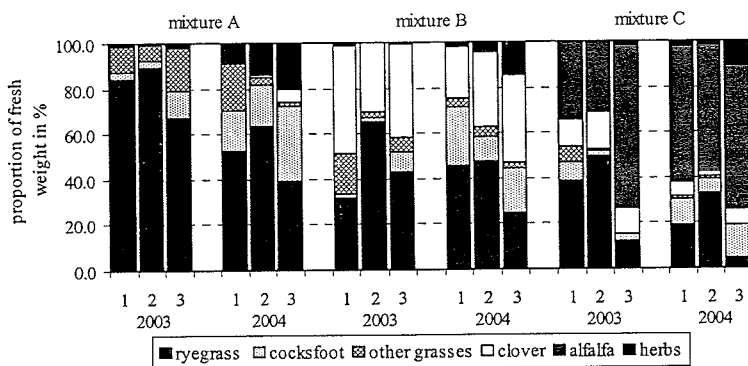


Figure 1. Changes in the botanical composition of the three mixtures within the cut and years.

Ash, crude protein and cell wall constituents of the three mixtures are shown in Table 1. The crude protein content increased in all mixtures from cut to cut in both years. But in 2003, the differences between the first and third cut were bigger than in 2004. Especially the forage of the second cut from 2003 had high crude fibre contents. The crude fibre, respectively ADF contents were higher in mixture C with alfalfa.

Table 1. Ash, crude protein, crude fibre, ADF and NDF contents ( $\text{g kg}^{-1}$  DM) of the three mixtures.

Mixture	Year	Cut	Ash	Crude Protein	Crude Fibre	ADF	NDF
A	2003	1	70	93	250	268	470
		2	95	113	275	304	513
		3	99	230	234	270	496
	2004	1	74	100	260	292	499
		2	117	123	243	272	471
		3	106	141	240	282	477
B	2003	1	89	139	252	283	463
		2	112	149	268	313	470
		3	99	220	222	266	462
	2004	1	86	131	254	294	484
		2	116	170	236	282	453
		3	113	174	245	282	467
C	2003	1	103	147	265	305	453
		2	108	143	309	359	499
		3	98	209	256	300	382
	2004	1	96	164	263	316	436
		2	125	210	241	287	419
		3	114	226	259	307	409

In all three mixtures the linolenic acid content (C18:3) was the dominant fatty acid (Table 2). The values varied between 8.6 and 12.8 g per kg DM. In 2004 in all mixtures the highest values were found in the second cut and the lowest values in the third cut. In 2003 no systematic trend was carried out. In mixture A the C18:3 concentrations were higher in 2003 in comparison to 2004. This is partly due to the higher proportion of cocksfoot, and in line with Dewhurst et al. (2001), who found higher

concentrations of C18:3 in ryegrass in comparison to cocksfoot. The average amount of linolenic acid in total fatty acids was 64.1, 64.3 and 60.7% for the three mixtures. The mixture C with the highest proportion of legumes (alfalfa) had the lowest amount of C18:3. Morand-Fehr and Tran (2001) showed that the stage of maturity influences the concentration of the fatty acids; however, it is difficult to see any differences between grasses and legumes.

The values of linoleic acid (C18:2) varied between 2.1 and 3.1 g per kg DM and the average amount was 15.4, 16.0 and 17.2% for the three mixtures. Similar values were also found for palmitic acid (C16:0). The average amount was 14.0, 13.8 and 14.8%. The three mixtures had low concentrations of stearic (C18:0) and oleic acid (C18:1) and their amount was lower than 3%.

Table 2. Fatty acid concentrations (g kg<sup>-1</sup> DM) of the three mixtures.

Mixture	Year	Cut	C16:0	C18:0	C18:1	C18:2	C18:3	Total FA
A	2003	1	2.1	0.2	0.5	2.4	9.3	15.7
		2	2.3	0.2	0.4	2.3	10.0	15.5
		3	2.4	0.3	0.5	2.5	12.2	18.9
	2004	1	1.9	0.2	0.4	2.3	8.9	13.7
		2	2.1	0.2	0.3	2.1	9.5	14.5
		3	1.9	0.2	0.3	2.2	8.8	13.4
B	2003	1	2.0	0.2	0.5	2.4	9.0	14.2
		2	2.4	0.3	0.4	2.6	10.3	16.2
		3	2.4	0.3	0.5	2.8	10.1	17.4
	2004	1	2.0	0.2	0.4	2.5	10.2	15.3
		2	2.2	0.2	0.3	2.5	12.8	18.3
		3	2.0	0.2	0.3	2.4	8.7	13.6
C	2003	1	2.3	0.2	0.4	2.8	10.3	16.3
		2	2.3	0.3	0.3	2.4	8.6	14.1
		3	2.5	0.4	0.4	2.6	9.2	17.2
	2004	1	2.2	0.2	0.4	2.8	9.2	15.2
		2	2.4	0.2	0.4	2.6	12.2	18.1
		3	2.3	0.3	0.4	3.1	8.8	14.8

### Conclusions

In all three mixtures, linolenic acid (C18:3) was the dominant fatty acid and the average amount was over 60%, followed by linoleic (C18:2) and palmitic acid (C16:0). Generally speaking the fatty acid composition of the three mixtures was similar.

### References

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