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Effects of conservation method on fatty acid composition of silage

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Abstract

This experiment was conducted to investigate effects of wilting and additives on the fatty acid (FA) composition of grass silage. The crop used was timothy (*Phelum pratense* L., cv. Grindstad), and the additives were Proens™ (formic acid and propionic acid, 60–66 g/100 g and 25–30 g/100 g, respectively), the bacterial inoculant Siloferm® Plus (*Pediococcus acidilactici* and *Lactobacillus plantarum*) and water (control). The wilted material reached a dry matter (DM) content of 336 g/kg at the first cut and 350 g/kg at the second cut. Neither wilting nor the additives had any major effect on the FA proportions, with the only differences in the concentrations of C16:0 and C18:3. Silage treated with bacterial inoculant contained a higher proportion of C16:0 ($P<0.05$) than silage treated with acid, and a lower ($P<0.05$) concentration of C18:3 than silage treated with either of the other two additives. In the silages, there were lower ($P<0.05$) proportions of C16:0, C18:0, C18:1 and C18:3, and higher ($P<0.05$) proportions of C16:1, C18:2 and other identified FAs, than in the fresh material. A wilting process shorter than 24 h, to a DM content of 330–350 g/kg, did not have any effect on the proportions of FAs in *P. pratense* L., cv. Grindstad. Since the different additives and wilting strategies tested in this study did not affect the proportions of FAs in silage to a major extent, the results indicate that such a process offers a robust means to avoid losses of FAs that can occur during wilting, while retaining the positive effects of wilting, such as reduced losses of nutrients through effluents.

Keywords: Silage; Acid additive; Bacterial inoculant; Wilting; Fatty acid composition

Abbreviations: DM, dry matter; FA, fatty acid; PUFA, polyunsaturated fatty acid.

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1. Introduction

The healthiness of dairy products for humans has been questioned since they constitute a considerable fraction of the diet for many people (Mann, 2002) and the majority of fatty acids (FAs) in milk are saturated (Bauman et al., 2006). Thus, it would be desirable to improve the FA profile of milk, and one way would be to modify the diet of dairy cows. The concentration and composition of unsaturated FAs in forage are of interest, since polyunsaturated FAs (PUFAs), such as linoleic acid (C18:2) and α-linolenic acid (C18:3), are considered to be beneficial constituents in human diet (*e.g.*, Leaf and Weber, 1988; Banni and Martin, 1998) due to their possible positive effects on health (*e.g.*, Simopoulos, 2001).

Ueda et al. (2002) found no differences in total FA concentration and composition between direct cut silage of legumes and the fresh material. However, in other cases ensiling can cause losses of PUFAs in herbage, and oxidation during field wilting has been identified as one of the main responsible factors (Dewhurst et al., 2003). Use of additives may also affect these variables, but reported findings in this respect conflict. For instance, Dewhurst and King (1998) found that although additives had major effects on overall fermentation parameters, their effects on levels and proportions of FAs in grass silage made from perennial ryegrass (*Lolium perenne* L.) were relatively minor. In contrast, Warren et al. (2002) found that use of formic acid or bacterial inoculants decreased total FA concentrations in perennial ryegrass and red clover (*Trifolium pratense* L.) silages. Boufaïed et al. (2003) found that use of a bacterial inoculant resulted in declines in the concentrations of C18:3 and total FAs in grass silage and haylage made from timothy (*Phelum pratense* L.).

Perennial ryegrass has been used in most previous studies in which relationships between these variables have been explored. To our knowledge there is no study with timothy investigating effects of wilting on the resultant silage, while simultaneously comparing different additives and their effect at different dry matter (DM) levels in the material used for ensiling. The objective of this study was to investigate effects of wilting and additives (*i.e.*, an acid additive and a bacterial inoculant) on the FA composition of grass silage made from timothy.

2. Materials and methods

2.1. Field management and sampling

The experiment was conducted in 2004 at the research centre Röbäcksdalen of the Swedish University of Agricultural Sciences in Umeå, Sweden (63°45′N; 20°17′E). A pure grass sward, consisting mainly of timothy (*P. pratense* L., cv. Grindstad), was used. Both the first (14 June) and second (29 July) cuts were included and the grass was mainly in the sheath elongation developmental stage when harvested. The grass was grown on a moderate loamy silt and the fertilisation level was 80 kg N/ha for the first cut and 40 kg N/ha for the second cut. Immediately after cutting, the fresh material was either ensiled within 2 h of cutting or placed on a tarpaulin for wilting to a dry matter content of 300–350 g/kg.