

Effects of partial substitution of concentrates with maize silage in organic dairy cow rations on performance and feed efficiency[†]

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Abstract

BACKGROUND: The general goal of organic dairy farming is to minimize purchased concentrate use and focus on milk production from forages. The aim of the present paper is to examine the influence of a partial substitution of purchased concentrates with home-grown maize silage on feed intake, milk production and feed efficiency in rations for organic dairy cows. In the experimental treatment group (E), two-thirds of average herd concentrate intake was replaced with 2.7 kg maize silage on a dry matter (DM) basis.

RESULTS: In treatment E, total DM, energy and protein intake were significantly reduced compared to the control treatment group (C). Daily milk yield decreased in E by 11% and milk urea content was significantly lower. Calculated milk production from forage was significantly higher (91 versus 71%) in treatment E. Efficiency of dietary nitrogen (N) utilization (calculated as milk N as a percentage of N intake) was slightly improved in E and protein and energy balance (calculated as intake as a percentage of requirements) were closer to zero than in C.

CONCLUSION: The present study indicates a potential to reduce levels of concentrates and substitute them with maize silage in organic dairy cow rations at least in the second half of lactation.

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Keywords: organic farming; dairy cow; protein; maize silage; milk production; feed efficiency

INTRODUCTION

Organic farming aims to reach a high level of self-sufficiency and to use its natural resources sustainably and efficiently. However, on many organic dairy farms, high amounts of external inputs are purchased in the form of concentrates, which must be viewed critically with regard to the following aspects: cost and availability of organically produced concentrates, forage utilization, intact nutrient cycles, use of fossil energy and the use of potential human food in animal feeding. Hence important goals in organic farming seem to be reducing concentrate use and maximizing the use of forages as well as increasing feed efficiencies.¹ Furthermore, organic field studies indicate that the protein and/or energy supply of organic dairy cows is often inadequate.^{2–5}

According to European and Austrian regulations, on organic farms 60% of the daily ruminant diet has to consist of forages.^{6,7} Hence grasslands are key components of organic dairy systems,¹ especially in

countries like Austria, where 56% of the agricultural area is permanent grassland.⁸ In organic dairy farming, but also in conventional low-input systems, grass and legume forages, which are important for nitrogen fixation and soil fertility, represent the main protein sources for dairy cows.

In these feedstuffs and their ensiled conserves, ruminal protein degradation occurs more rapidly than carbohydrate degradation.^{9,10} If ruminally degradable feed protein and energy in the form of readily fermentable carbohydrates are not available in the rumen at the same time, high amounts of nitrogen cannot be utilized and must be excreted through urine and milk.¹¹ Therefore, several researchers have suggested supplementing grass–legume silage-based diets with maize silage, which is high in ruminally fermentable carbohydrates and low in protein.^{12–15} Recent research shows that maize silage is also under organic farming conditions a reliable forage supplement that can be grown in most grassland regions of moderate altitude, and

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