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Article

Effect of feeding fresh or conditioned red clover on milk fatty acids and nitrogen utilization in lactating dairy cows

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Abstract

Polyphenol oxidase (PPO) in conditioned red clover (ensiled or cut and crushed) reduces both proteolysis and lipolysis in the herbage, which has led to increases in N use efficiency and polyunsaturated fatty acid (PUFA) content of milk when offered to dairy cows. In damaged plant cells, PPO is activated and binds protein through the formation of protein-bound phenols. This study investigated a) whether freshly cut red clover could increase N use efficiency and milk PUFA concentrations in dairy cows or whether PPO enzymes require prior activation before feeding to elicit a response, and b) apparent whole-tract amino acid digestibility to help determine the effect of PPO on amino acid utilization. Six multiparous Holstein \times Friesian dairy cows in mid-lactation were allocated at random to 1 of 3 dietary treatments in a 3×3 Latin square: a control

treatment of grass (low PPO, G); red clover (high PPO, RC), and conditioned red clover (high fully activated PPO, CRC). The CRC herbage was cut and chopped in the field and then transported with the G and RC herbages to the animal house. Each period consisted of a 2-wk adaptation to diet and a week of measuring dietary effects (N balance and milk collection). The PPO activity was greatest in the RC treatment as fed, whereas activation of latent PPO enzyme and protein-bound phenol levels were greatest in the CRC diet. Dry matter and total fatty acid intakes were comparable across treatments (18.8 kg/d and 550 g/d, respectively). Milk yields and total fatty acid content were similar across treatments (32.6 kg/d and 34.8 mg/mL, respectively). Cows offered either RC or CRC had greater levels of protein, C18 PUFA and total long-chain PUFA in their milk than animals offered grass with no difference between RC and CRC. Nitrogen intakes, and output in milk, urine, and feces were greater in cows offered the 2 red clover treatments than G, with no difference between RC and CRC. However, there were no differences in N use efficiency among diets as measured by the proportion of feed N converted into milk N, possibly as the result of the excessive supply of N with the red clover diets. Amino acid apparent whole-tract digestibilities were greater when on RC than G diets and intermediate when on CRC for all amino acids, with the exception of Met, which was reduced in cows on both red clover diets compared with G. It is proposed that the PPO trait could show more benefit to ruminants if red clover was fed in combination with lesser N-containing forages or if red clover was bred to contain less N.



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Key words

red clover; polyphenol oxidase; N use efficiency; polyunsaturated fatty acid

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