Selenium and Sulfur Supplementation to Steers Grazing Tall Fescue

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ABSTRACT

Forty steer calves averaging 257 kg were allotted to a randomized complete block design experiment containing 10 animals per treatment. Four tall fescue pastures of 5.7 ha each were utilized during the 84-d grazing study. Each pasture treatment block contained 10 calves. Calves were fed a control supplement of 96.9% ground corn and 3.1% trace mineral salt in two pastures, or a sulfur supplement that contained 94.3% ground corn, 3.1% trace mineral salt, and 2.5% elemental sulfur in the remaining two pastures. Each supplement was fed at the rate of 0.45 kg/head daily. One-half of the calves in each pasture were injected with 15 mg selenium (Se) as sodium selenite initially and at 28-d intervals throughout the trial. The treatments were as follows: (1) control—no sulfur, no selenium; (2) selenium, no sulfur; (3) sulfur, no selenium and; (4) selenium plus sulfur. Calf weights were monitored and certain blood parameters measured every 28 d. Average plasma Se values were increased ($P < 0.001$) from 0.021 ppm in calves not receiving Se to 0.043 ppm in those receiving Se. Plasma urea nitrogen levels were not affected by Se administration, but were lowered ($P < 0.05$) from 16.6 to 15.8 mg/100 mL by sulfur administration. All plasma amino acids measured, except methionine, phenylalanine, arginine, and citrulline, were cleared from the blood in response to Se supplementation as reflected by their lower concentrations when compared with other treatment groups. Overall average daily gains were not significantly ($P > 0.10$) increased by sulfur supplementation, but were increased ($P < 0.05$) from 0.33 kg/d in calves not receiving Se to 0.43 kg/d in those receiving Se injections. Significant interactions between sulfur and Se were not noted.

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INTRODUCTION

Since Schwartz and Foltz (1) reported that selenium was an essential trace element for mammals, the importance of trace amounts of this element in the diets of ruminants has been well established (2-5). There is evidence that selenium uptake can be compromised by the presence of chemically similar forms of sulfur in plants (6,7), in microorganisms (8), and in rats (9-11). However, consistent evidence for a similar mechanism operating in the ruminant system has not been clearly demonstrated (12). Little work of this type has been done in animals grazing tall fescue pastures. Tall fescue (Festuca arundinacea Schreb) pastures predominate in our area and, when grazed throughout the summer, this forage usually does not provide the ruminant with all the nutrients necessary for maximum performance. The level and availability of certain nutrients throughout the summer has been questioned. Selenium and sulfur are two such nutrients that seem either to be present at suboptimal levels or relatively unavailable to the ruminant grazing fescue in the south central United States. Selenium levels appear to be marginal in many pastures. Andrews et al. (13), using sheep grazing pastures low in selenium, reported that animals supplemented with selenium made significantly greater body weight gains relative to untreated animals. Sulfur, on the other hand, which appears to be present at adequate levels, may be available only at suboptimal rates (14-16). This, linked to the possible antagonism between these two elements, led to the present study, which was conducted to evaluate the performance of steers grazing a pure stand of fescue when supplemented with selenium and/or sulfur.

METHODS

Forty steer calves averaging 257 kg were allotted to a complete randomized block design experiment of four treatments containing 10 animals per treatment. Treatment groups included five calves and were replicated twice. Four pure fescue pastures of 5.7 ha each were utilized. Calves were fed a control supplement in two pastures and a sulfur supplement in two pastures. The composition of these supplements is presented in Table 1. The supplements were fed at the rate of 0.45 kg/head daily. Each pasture contained 10 calves. One-half of all calves in each pasture received an injection of 15 mg selenium as sodium selenite initially and at 28-d intervals throughout the trial. Therefore, the treatment groups were as follows: