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Dry matter intake, *in vivo* nutrient digestibility and concentration of minerals in the blood and urine of steers fed rice straw treated with wood ash extract

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Abstract

Studies to evaluate the effects of feeding rice straw treated with wood ash extract (WAE) on dry matter (DM) intake, *in vivo* nutrient digestibility and mineral concentrations in the blood and urine were conducted using 12 Boran steers. The steers were randomly assigned to three treatments consisting of untreated, urea treated and WAE treated rice straws in a completely randomised design to estimate the voluntary DM intake. All animals were supplemented with 2 kg of concentrate. An *in vivo* digestibility trial was performed and pH and mineral contents determined in the urine and blood samples.

The average voluntary DM intakes were 5.56, 5.92 and 5.81 kg/day for untreated, urea and ash treated rice straws, respectively, and the mean differences were not significant. Values for DM and organic matter (OM) digestibility of ash treated rice straw (0.633 and 0.684) were higher ($P<0.01$) than those of urea treated (0.579 and 0.643) and untreated (0.559 and 0.617) straws. Neutral detergent fibre (NDF) digestibility of WAE (0.726) and urea (0.689) treated straws were higher ($P<0.05$) than untreated (0.606) straw. Calcium concentrations in the blood plasma of steers fed WAE treated (94.8 mg/l) and untreated (99.3 mg/l) straws were lower than those fed on urea treated rice straw (104.9 mg/l). Values of urinary excretion of calcium by the steers fed on WAE (1.88 mg/l) and urea

Abbreviations: ADF, acid detergent fibre; CP, crude protein; DM, dry matter; OM, organic matter; ME, metabolisable energy; NDF, neutral detergent fibre; VFI, voluntary feed intake; WAE, wood ash extract

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(1.74 mg/l) treated straws were lower (P<0.05) than those fed on untreated (5.93 mg/l) straw. Magnesium concentration in the blood and urine of steers fed on WAE treated rice straw (20.5 and 104.7 mg/l) were lower (P<0.05) than in those fed on untreated (28.7 and 660 mg/l) and urea treated (29.6 and 628 mg/l) rice straw. The blood sodium level was not influenced by the treatments, though the urinary excretion of sodium was lower (P<0.05) for steers fed on WAE treated (620 mg/l) than those fed on urea treated (1689 mg/l) and untreated (1049 mg/l) straws. It is concluded that wood ash extract is effective in improving the nutritive value of low quality roughage and short time feeding of WAE treated straw has no detrimental effect on the mineral concentration in the urine and blood of the animals.

Keywords: Rice straw; Wood ash treatment; Intake; Digestibility; Body minerals

1. Introduction

Wood ash contains minerals such as calcium, potassium and sodium, which give it alkaline properties (Tiisekwa et al., 1999). The alkaline property improves nutrients digestibility of low quality roughages through solubilisation of silica and weakening of bonds between lignin and cellulose. Straws and stover treated with wood ash extract (WAE) have been shown to have lower lignin, neutral (NDF) and acid (ADF) detergent fibre contents (Nolte et al., 1987; Ramirez et al., 1992) and increased levels of ash (Nolte et al., 1987). Using WAE for soaking wheat straw and maize stover, Nolte et al. (1987) and Ramirez et al. (1992) observed significant increased *in vivo* digestibility of DM, OM, NDF and ADF by goats. Nolte et al. (1987) reported greater dry matter intake by goats fed on WAE treated (4.9 kg DM/day) compared with untreated (4.4 kg DM/day) wheat straw.

Wood ash treated materials contain a high concentration of ash (Mohamed and Ali, 1988; Ramirez et al., 1992), which implies high mineral contents. Information on how this ash will affect mineral concentration of the body fluids of animals consuming those materials is not well known. The review by Kristensen (1981) on the effects of feeding NaOH treated straw on animal health, revealed that blood levels of phosphorus and magnesium were significantly reduced in young bulls fed on NaOH treated straw for longer than 12 weeks. Arndt et al. (1980) showed that feeding cattle on NaOH treated cotton plant increased sodium levels in the urine of those animals. Limited information is available on the voluntary food intake (VFI), *in vivo* digestibility and mineral concentration in the fluids of animals fed on rice straw treated with WAE. The present study attempts to measure those parameters in Boran steers fed on rice straw treated with WAE.

2. Materials and methods

2.1. Experimental design and treatments

Twelve, 1-year-old Boran steers with mean weight 183 ± 10 kg were allocated into three treatments in a completely randomised design. Treatment 1 was a control, where animals