Variation in the chemical composition, physical characteristics and energy values of cereal grains produced in the Western Cape area of South Africa

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Abstract

Grain samples were produced at 10 different locations in the Western Cape region of South Africa, on 2.1 m x 6 m experimental plots, over a period of three years. Twenty different cereal grain cultivars were used in the study. A randomised square experimental design with four replicates per sample was used. An area of 1.35 m x 5 m from each plot was harvested during 1994, 1995 and 1996 and the yield was determined. Thousand seed mass (TSM) and hectolitre mass (HLM) were also determined. Samples were analysed for dry matter (DM), ash, crude protein (CP), ether extract (EE), neutral detergent fibre (NDF), acid detergent fibre (ADF) and *in vitro* organic matter digestibility (IVOMD). Digestible energy values (DE) for pigs were determined with a mobile nylon bag technique, while non-structural carbohydrate values (NSC) were calculated. In the first analysis, cultivars were compared by a one-way analysis of variance, followed by pooling of grain type data. Naked oats had the highest DE value, and the respective values (DM basis) for naked oats, wheat, triticale, 2-row brewer's barley, 6-row feed barley and oats were 18.0, 16.0, 15.8, 14.9, 14.4, and 12.6 MJ/kg DM. The high EE value of naked oats (97 g/kg) might be partly responsible for the high DE value. The 6-row and 2-row naked barley cultivars had the highest IVOMD (946 g/kg and 944 g/kg), followed by wheat (910 g/kg), triticale (905 g/kg), naked oats (899 g/kg), 2-row brewer's barley (882 g/kg), 6-row feed barley (844 g/kg) and oats (671 g/kg). Considerable variation was found between samples within a cultivar for DE and IVOMD. Two-row naked barley had the highest mean CP value (159 g/kg) followed by naked oats (159 g/kg), 6-row naked barley (154 g/kg), wheat (148 g/kg), triticale (146 g/kg), oats (143 g/kg), 2-row brewer's barley (136 g/kg) and 6-row feed barley (135 g/kg) on DM basis. Triticale had the highest yield, with naked oats and barley cultivars having the lowest yield.

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Introduction

Approximately 75% of the total cost of intensive animal production is due to feed costs (Brand, 2000). Maize, which is traditionally the main energy source in diets of intensively fed animals, is grown mainly in the northern summer rainfall regions of South Africa. This leads to an additional transport cost of approximately 15% added to the price of maize in the Western Cape. Researchers have been forced, therefore, to investigate alternative grains that can be produced and used as a possible alternative in the Western Cape. An advantage of cereal grains *vs*. maize in diets is their higher protein content which allows lower inclusion levels of expensive protein sources, and hence a cost reduction of the final diet. Most of these cereal grains have been evaluated locally in balanced diets. These include barley (Kritzinger & Olckers, 1985), naked oats (Brand & Van der Merwe, 1996), wheat (Kemm *et al*., 1986) and triticale (Horsten, 1977; Brand *et al*., 1995) for monogastric animals, and barley (Brand & Swart, 1999; Lehmann *et al.,* 2002) and triticale (Du Plessis, 1989; Griessel, 1991; Brand & Van der Merwe, 1996) for ruminants. Most of these studies indicate that maize can be replaced successfully by cereal grains, depending on the prices of both grain types. The current study was planned to obtain information on the variation in the chemical composition and energy value of different types and cultivars of cereal grains produced in the Western Cape area of South Africa. Such information is essential in the formulation of diets for optimal livestock production.

Materials and methods

Cereal grain samples were collected from experimental plots at 10 different locations in the Western Cape region of South Africa. Samples were obtained from grain produced on 2.1 m x 6 m experimental