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Short communication

Replacement of corn grain by brown rice grain in dairy cow rations: Nutritional and productive effects

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ABSTRACT

The use of brown rice grain as corn grain replacer in dairy cow diets was investigated. The following treatments were evaluated: zero, 33, 63, and 100%. The experimental diets were iso in protein, energy and fiber levels. Eight multiparus Jersey cows were used. A replicated Latin square experimental design was applied. The inclusion of brown rice had no effect ($P > 0.05$) on dry mater intake and their constituents, apparent digestibility, production and milk composition, feed efficiency and blood chemistry profile. Therefore, the brown rice grain can be used replacing corn grains alternative feedstuff in dairy cow diets.

1. Introduction

Although rice is produced worldwide, an increase of productivity due to technology, consumption has been reduced due to changing habits of western populations. Therefore, alternative uses for rice, like their use in animal feeding, may contribute to market stability and balance of world stocks. Several studies have been carried out to evaluate rice by-products, like rice bran or defatted bran (Nörnberg, 2003) and whole plant silage (Maruyama et al., 2005). When rice is dehulled but not polished, more fat, protein and minerals are maintained and, for that the nutritional value is similar to corn grain (Table 2). Nevertheless, there are no results for the use of brown rice in animal feeding. Thus, the use of brown rice grain in animal feed may represent an important alternative for integrated crop and livestock production systems, contributing to balance and improve the productivity of agribusiness.

Abbreviations: SCC, somatic cell count; SCE, somatic cells score; DM, dry matter; OM, organic matter; CP, crude protein; EE, ether extract; ADFom, insoluble acid detergent fiber corrected for ash; aNDFom, insoluble neutral detergent fiber corrected for ash; ADL, acid detergent lignin; Cr, chrome; NFC, non-fibrous carbohydrates; DE, digestible energy; ME, metabolizable energy; NEl, net energy oflactation; NEFA, non-esterified fatty acids; BW, body weight; ECM, energy corrected milk; FE, feed efficiency.

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We hope to define the basis to include brown rice in dairy cattle feeding, and then the option for that usage will be determined by the price relationship between it and the other grains. The objective of this study was to evaluate the inclusion of brown rice grain replacing corn grain in dairy cow diets, measuring production and milk composition, feed intake, digestibility, feed efficiency and blood parameters.

2. Material and methods

2.1. Animals and location

The experiment was carried out between September and December, 2012, in the experimental farm of Brazilian Agricultural Research Corporation (EMBRAPA), located in Capão do Leão (31°52′20″South latitude and 52°21′24″West longitude), Rio Grande do Sul, Brazil. Milk component and chemical analyses were carried in Embrapa laboratories, at that experimental station. The work was carried out in accordance with the Ethics Committee of Federal University of Pelotas, Brazil, registered under protocol 4844.

Eight cows with Madio weight of 379 ± 28 kg and milk production of 20 ± 2 kg between second and fourth lactation, were housed in free stall and adapted to the experimental diets for 15 days before the start of the experiment. They had free access to drinking water.

2.2. Treatments and experimental diets

Replacement levels of corn by rice were zero, 33, 63.67, and 100%. The experimental diets (Table 1) were formulated to reach the same levels of energy, crude protein and neutral detergent fiber (Table 2), according to NRC (2001) profiles. The

Table 1
Diets composition.

Ingredients (g/kg of DM)	Treatment			
	R0	R33	R63	R100
Forage[a]	524.2	520.3	523.6	515.1
Concentrate	475.8	479.7	476.4	484.9
Corn, grain	357.1	239.6	130.0	–
Brown rice, grain	–	120.5	227.8	364.3
Soybean, meal	102.4	103.2	102.3	104.0
NaCl	1.6	1.6	1.6	1.7
Mineral – vitamin[b]	13.2	13.3	13.1	13.4
Dicalcium phosphate	1.5	1.6	1.5	1.6

R0 = without rice inclusion; R33 = 33.46% rice; R63 = 63.67% rice; R100 = 100% rice replacing corn.
[a] Mixture of corn silage 487 g/kg of mixture, the remainder being alfalfa hay, on a dry mater basis.
[b] Minimum composition per kg: Ca – 229 g; P – 95g; Mg – 1.1g; Na – 60g; S – 12g; Vit. A – 120,000 UI; Vit. D3 – 30,000 UI; Vit. E – 1200 UI; Se – 20g; Zn – 3g; Lasalocid – 1000 mg.

Table 2
Chemical composition of the diets and ingredients.

	DM	OM	CP	EE	aNDFom[b]	NFC	NEl
	g/kg	g/kg DM	g/kg OM				MJ/kg OM
Diets							
R0	474.9	927.3	184.6	30.9	338.0	427.0	7.1
R33	476.1	927.9	184.2	30.0	335.1	430.0	7.2
R63	483.7	928.5	184.0	29.9	334.5	431.5	7.1
R100	482.8	927.7	184.0	28.8	329.0	437.5	7.2
Ingredients							
Corn, silage	223.8	931.9	93.8	38.1	652.9	215.2	6.3
Alfafa, hay	812.2	896.1	239.9	34.9	481.8	243.4	5.8
Corn, grain	810.7	979.1	91.3	31.7	88.19	749.4	8.6
Brown rice, grain	848.1	984.1	89.7	27.7	77.37	765.2	8.7
Soybean, meal	849.5	932.7	605.4	22.4	161.9	210.2	10.7
NaCl	985.4	28.0	–	–	–	–	–
Mineral – vitamin[a]	956.4	135.3	–	–	–	–	–
Dicalcium phosphate	931.9	94.0	–	–	–	–	–

R0 = without rice inclusion; R33 = 33.46% rice; R63 = 63.67% rice; R100 = 100% rice replacing corn.
[a] Composição mínima por kg: Ca – 229g; P – 95g; Mg – 1.1g; Na – 60g; S – 12g; Vit. A – 120,000 UI; Vit. D3 – 30,000 UI; Vit. E – 1200 UI; Se – 20 g; Zn – 3 g; Lasalocida – 1000 mg.
[b] Neutral detergent fiber using a heat stable amylase and corrected for ash, without the use of sodium sulfite.