NUTRITIONAL POTENTIAL OF RICE BASED DISTILLERY BY-PRODUCTS FOR FEEDING OF DAIRY CATTLE

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Abstract: In India the low quality rice and broken rice is increasingly being used in the ethanol industry. Rice Distillers Grain with Soluble (RDGS) and Rice Condensed Distillery Syrup (RCDS) are two byproducts having good potential to be used as alternative feed resources for the ruminants. The data on chemical composition of RDGS indicates that It is an excellent source of crude protein with CP content more than MOC and GNC and similar to SBM. RDGS is also a good source of ether extract rich in oleic and lenoleic acid. Low crude fiber content further enhance its nutritive value. RCDS was found to be a good source of crude protein, some fatty acids (palmitic acid, oleic acid and linoleic acid) and also soluble carbohydrates. Comparative mineral content showed that RCDS contained slightly higher Ca, P and Mg content than RDGS. Cu and Fe content were higher in RDGS than RCDS, whereas Zn content was higher in RCDS. Both RDGS abd RCDS are having good potential to be used as alternative source of protein in the diet of lactating and growing dairy cattle

Keywords: Rice, Distillers Grain with Soluble, Condensed Distillery Syrup, Dairy Cattle.

Introduction: Feed accounts up to at least 60% of total expenditure of a farm. One of the main reasons for low productivity in dairy animals in eastern India is inadequate and imbalanced feeding. At present, the country faces huge deficit green fodder and concentrate feeds. The available feeds and forages are poor in quality, being deficient in energy, protein and minerals. The situation is further aggravated due to increasing growth of livestock particularly that of genetically upgraded animals.

Ethanol production has increased over the past 10 years, resulting in greater quantities of ethanol byproducts known as distillers grains and soluble [1]. In India 536.5 thousand litre ethanol was produced in 2009. This amount will increase significantly in future to fulfil the demand of fuel as well as the liquor industry. Grains are the primary resources for ethanol production using either a wet milling or dry-grind process. Conventional ethanol production consists of 6 sequential steps, which include dry milling, liquefaction, saccharification, fermentation, distillation, and co-product recovery. Wet distillers grains (WDG), dried distillers grains (DDG) and dried distillers grains with solubles (DDGS), Condensed Distillery Syrup (CDS) are the by-products derived from artisan production of alcohol from grains and these by-products are cheap and available round the year.

RDGS and RCDS: Distillers Dried Grains with Solubles (DDGS) is the product obtained after the removal of ethyl alcohol by distillation from the yeast fermentation of a grain or a grain mixture by condensing and drying at least ¾ of the solids of the resultant whole stillage and drying it by methods employed in the grain distilling industry. The predominating grain shall be declared as the first word in the name. Accordingly the DDGS product obtained from Rice Distillery is called Rice Distillers Dried Grains with Solubles (RDGS or RDDGS) and the condensed distillery syrup or soluble are called Rice Condensed Distillery Syrup (RCDS). In India the low quality rice and broken rice is increasingly being used in the ethanol industry. So in future, a large amount of rice based distillery byproducts is likely to be available in the country.

Rice Distillers Grain with Soluble (RDGS) is a very good source of protein, fibre and minerals. Thus, it can be an excellent animal feed resource for reducing ration cost, replacing portions of expensive protein meals such as soyabean meal, fish meal, canola meal, groundnut cake, maize gluten meal etc. and hence, reducing the feed cost for farmers and feed manufacturers.

The rice condensed distillery syrup (RCDS) is another major byproduct of rice based distillery Industry which is potent source of protein and other essential nutrients. However, high moisture content (60-70%) adversely affects its keeping quality and thus decreases its potential as feed resource.

Comparative Nutrient Composition in RDGS & RCDS: The DM% of RDGS was 89.58 ± 0.09. The proximate composition (% DM) in terms of OM, CP, EE,CF, NFE and Total Ash were 94.97±0.09, 48.43±0.69, 5.45±0.16, 7.27±0.07, 33.86±1.15 and 5.03 ± 0.09, respectively. The concentration of other nutrients namely, NDF, ADF, Cellulose, Hemicellulose, ADL,TCHO, NSC and AIA were 40.50 ± 0.9, 16.82 ± 0.6, 7.65 ± 0.24, 23.68±1.12, 7.19 ± 0.53, 42.91± 1.5, 2.40 ± 0.68 and 0.95 ± 0.06, respectively.

Proximate analysis indicated that RCDS was a fair source of protein (228.4 g/ kg). The mean concentration (% of DM) of CF, EE, TA, AIA, TCHO and NFE of RCDS were 0.65±0.04, 1.00±0.02, 9.70±0.38, 1.32±0.14, 66.17±0.99 and 65.81±0.99, respectively. Fibre fractionation indicated that RCDS contained very less fibre. Mean value of NDF, ADF,

hemicellulose and NSC were 2.61±0.27, 1.05±0.11, 1.39±0.41 and 63.90±0.97 respectively. Cellulose and ADL were not detected in RCDS.

Comparative protein fractions revealed that fraction $P_{A,}$ and P_{B1} of RCDS (21.30 and 23.85, respectively) were higher than RDGS (12.07 and 18.57, respectively) indicating higher Rumen Degradable Protein (RDP) content in RCDS as compared to RDGS. Fraction P_{B2} of RCDS (54.85) was higher than RDGS but fraction P_{B3} and Pc were negligible or non- detectable in RCDS. The sum of fraction $P_{B2,}$ P_{B3} and Pc were around 70 percent which was higher than RCDS. ,

The macrominerals content (% DM) in RDGS and RCDS were 1.13 & 1.44; 0.70 & 0.95; and 0.41 &1.13 respectively for Calcium, Phosphorus and Magnesium. The micromineral content (mg/kg DM) in RDGS and RCDS were 31.51 & 24.64; 90.36 & 198.38; 95.72 & 106.7 ; and 622.3 & 384.1 respectively for Copper, Zinc , Manganese and Iron. Comparative mineral content showed that RCDS contained slightly higher Ca, P and Mg content than RDGS. Cu and Fe content were higher in RDGS than RCDS, whereas Zn content was higher in RCDS. The Mn content was almost similar in RDGS and RCDS

Potential of RDGS and RCDS as Ruminant Feed:

Rice Distillers Grain with Soluble (RDGS) and Rice Condensed Distillery Syrup (RCDS) are having good potential to be used as alternative sources of protein for the ruminants. In India the low quality rice and broken rice is increasingly being used in the ethanol industry. So in future, a large amount of RDGS and RCDS are likely to be available in the country. RDGS is a very good source of protein, Fibre and minerals. It is a good source of phosphorus and maximum of it present as non phytate form which is readily available to animal. Thus, it can be an excellent animal feed resource for reducing ration cost, replacing portions of expensive protein meals such as soybean meal, fish meal, canola meal, groundnut cake, maize gluten meal etc. and hence reducing the feed cost for farmers and feed manufacturers.

The nutrients in distillers' grains are closely related to the grains from which they are made. These byproducts are utilized gas animal feeds in beef and dairy diets, as well as other animal production systems [2]. This continuing increase in ethanol production has changed the animal feeding systems due to the large supply of byproducts originating from the milling process. Distillers grains with solubles have been reported to be a good source of rumen undegradable protein (RUP) and energy for ruminants and may be included up to approximately one third of the diet for lactating dairy cows [3]. Distiller's grain is being fed to poultry and aquatic animals as a protein source. It may provide livestock with high protein content with good amino acid profile as compared to other common protein supplements. RDGS may have a comparable or higher biological worth than other rice byproduct and other fermented byproduct because of its low cost and comparable performance results. It can be ideally used as a primary feed, not just because it contain high protein, but also due to high NDF and mineral content. Data available indicate that the composition usually reflects the nutrient content of the grain after removal of starch via fermentation to ethanol. Reports are there [4] on reduction in CH_4 production in dairy and beef cattle when DDGS was added to the ration .

The concentrations of protein, fat, fibre and other nutrients in the DDGS from various grain sources usually reflect proportionately increased concentrations of those components relative to the starting grain after starch removal. Other similar product like corn DDGS, sorghum DDGS, barley DDGS, wheat DDGS are being used in livestock and poultry feeding. Work done on utilization of these DDGS on various domestic animals, poultry and aquatic life is available but very little information is available on utilization of RDGS and RCDS in livestock feeding in general and ruminants in particular.

In a recent study conducted at National Dairy Research Institute, Kalyani [5], it has been found that the incorporation of RDGS replacing SBM significantly improved the digestibility of DM, CP and EE in growing Jersey crossbred cattle without any adverse effect on DM and nutrient intake. The growth rate improved significantly in RDGS fed group without any adverse effect on blood parameters and the feed conversion efficiency also improved by around 18 percent. The studies on lactating dairy cattle [6] showed that there was no adverse effect of RDGS supplementation replacing SBM on milk yield, feed conversion efficiency and milk composition. The increase in milk yield and FCM yield by around 5.6 and 4.1 %, respectively in RDGS fed group as well as the much lower cost of RDGS than SBM have resulted in improvement in net profit margin in RDGS fed group.

Studies conducted at National Dairy Research Institute, Kalyani on feeding of RCDS [7] in dairy cattle ration reveled that feeding of RCDS (@ 15% of concentrate mixture on DM basis) to growing crossbred calves resulted no adverse effect on voluntary intake, growth performance, nutrient digestibility, availability of nutrients and blood parameters. During lactation trial [8] , there was no significant difference in DM Intake and milk composition in crossbred cattle when 15% (DM basis) of concentrate mixture was replaced by RCDS. The milk yield, 4% FCM yield and feed conversion efficiency (kg DMI/kg FCM yield) were also unaffected. The replacement incorporation of RCDS

(@15% of conc. Mix.) of conventional concentrate mixture economized the ration and reduced the cost of milk production.

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