

Review Article**USE OF RICE BY-PRODUCTS IN LIVESTOCK INDUSTRIES OF NEPAL****Mohan P. Sharma, PhD**Professor, AFU, Chitwan
Email: mohan.shr@gmail.com**Abstract**

Food crop production generates large volume of by-products whose proper utilization can be unrecognized, which can lead to less economic return to farming communities. The rice industry is chief farming activity in Nepal which yields large quantities of by-product which includes straw, husk, bran, deoiled cakes and broken rice. The aim of this article is to present a review of the use of these by-products in livestock industries. We performed theoretical research about the utilization of rice by-products in various areas within livestock industries. The findings point to proper utilization of all rice by-products in lucrative area. Rice straw and husk is popularly used as livestock bedding material especially in poultry farms. Rice straw is also used as feeding material for large ruminants with or without certain physical and chemical modifications. Other high energy by-products like rice bran and rice polish are used in livestock feed. These by-products also have high market price and have least share in import figures compared to other feed ingredients which can be worthwhile for nation's economy. As feed cost is high and replacing expensive ingredients with fairly less expensive rice products will cause substantial benefit for livestock industry. Moreover, yearly increase in use of rice by-products in livestock industries indicates its prospect.

Keywords: Rice by-products, straw, husk, bran, livestock industry, Nepal

Introduction

Livestock plays crucial role in supporting the livelihoods of farming communities in the context of crop livestock integrated farming system in Nepal. In spite of several efforts in the past, productivity of livestock are remained at low level mainly due to shortage of feed along with other lacking such as breeds and health management (Devkota et al 2014). Nepal is an agrarian country with typical crop livestock mixed farming system in majority of the part of the country. Livestock is an integral part of Nepalese farming system that shares about 26 percent to the agricultural gross domestic products (MoAD 2013).

Feed is the major input cost in animal agriculture, accounting for 65-70% of the total rearing cost. Poor nutrition of animals has been identified as the major constraint to animal production across the developing world (FAO 2000). Due to variety of reasons, the tropical world is largely faced with the problem of acute shortage of feed resources.

Crop by-products which are important feed supplements in ruminant feeding include rice bran, wheat bran, flaked rice bran, rice polishing, maize bran, mixed cereal bran, grain legume by products

and oil seed cakes such as mustard cake, soybean cake, cotton seed cake, and ground nut cake. These by products are normally supplements to dairy rations and used as raw materials for commercial feeds. Annually three million tons of dry roughage as crop residues are produced in the country. About 70% of crop residues are used by ruminant livestock as feed and remaining 30% are used as roofing and bedding materials (Shrestha et al 2014). Cereal straws are major source of bulk and energy for ruminants. However since last few years, even the straws have become an expensive commodity (1994-Rs 1/kg, 2004-Rs. 2/Kg, 2014- Rs 4-5/kg). The feed deficit in hilly region and Tarai region is -56%, -42% whereas there is 26% feed surplus in mountain region. 60% of livestock feed requirement comes from low quality crop residues. Thus, most of livestock in Nepal have to depend on crop residues and by-products (Forage seed production area mapping 2002). The situation is by no means as hopeless as projected. Our country has many other resources which can sustain livestock which have ability to digest coarse materials. Rice straw, rice bran and rice polish are some of the available rice based feeding materials for livestock in Nepal.

The trend of using concentrate feed has become popular in commercial rearing. Rice and rice by-products are second most important feed ingredient after maize while formulating animal feed. In rural areas, rice polish and bran (from local rice mills) are mainly used to feed ruminants as feed supplements (Yadav 2014). In Nepal, only 10.8 percent of total grain requirement (464 million M tons/year) is available for feeding livestock (Yadav 2014).

Technologies for use of rice straw for animal feeds in Nepal

Dry roughage, particularly crop residues, such as rice straw, wheat straw, corn stover, oat hay, residues of millet and buckwheat, residues from oil seed crops etc are important sources of animal feeds. Among them, rice straw is one of the most important source of bulk and energy for ruminants. Rice straw is used in various ways to feed animals in Nepal. Some of the technologies to use rice straw as source of animal feed in Nepal is discussed below:

Bailing of straw/hay

There are three main types of bales that can be made for feeding livestock: small bales, large square bales and large round bales. Large round bales are quite popular among many livestock producers. Large round bales (LRBs) are made up of by a tractor with round straw baler (Pandey 2014).

Chopping/chaffing of straw

Some benefits of chopping or chaffing straw are increment in palatability and digestibility, ease in handling fodder quantity. Traditional and multifunctional chaff cutters are in practice to chaff the straw in Nepal (Pandey 2014).

Urea treatment of straw

Treating with urea is based upon its transformation into ammonia. In order for the treatment to succeed, most of the urea must first be hydrolyzed into ammonia and then this must diffuse correctly so fixing itself to the forage and modifying it chemically. One must therefore ensure favorable conditions for both good ureolysis and good ammonia treatment, in the knowledge that these two processes take place simultaneously within the forage matter. Efforts have been made to reduce urea application rates to 2 or 3% by mixing it with lime, $\text{Ca}(\text{OH})_2$ which favors the urea hydrolysis and above all, the alkaline reaction.

Work concerning this aspect is still at an experimental stage (Pandey 2014).

Common procedure of urea treatment

Polythene sheet should be spread over on selected site. The one fourth paddy straw will be spread over the polythene sheet. The water urea solution (4 kg urea / 40 liter water/100 kg straw) will be sprinkle over the paddy straw and mixed properly. Then, next one fourth paddy straw will be spread over and again urea solution will be sprinkle till completion of the straw. The treated straw will be air tight and kept for 21 days (Pandey 2014). Owen and Jayasuriya (1989) reported higher milk yield in treated condition (2.97 kg/day mild yield) in comparison to no treatment (2.17 kg/day)

Straw blocks

To meet the challenges during emergency situations, straw blocks have generally the composition of 80 parts straw, 10 parts molasses, 2 parts mineral mixture, 1 part urea and 1 part salt, which could meet the maintenance requirement of the animals. The proportion of straw feeding should be reduced to 60, 50 and 40% for animals yielding 5-10, 10-15 and 15-20 kg milk per day respectively (Pandey 2014).

Complete feed

Complete feed is a homogenous mixture of feed ingredients (concentrates and roughages), which contain nutrients (proteins, carbohydrates, fiber, fat, minerals and vitamins) and also meet the dry matter requirement of animals. Complete feed is more balanced feed and can be fed as per requirement of the animals. The technology of straw based densified complete feed as blocks or pellets could play an important role in providing balanced rations to livestock in during green forage scarcity. A concentrate mixture using maize grain, soya bean meal, ground nut cake, rice bran, mineral mixture and common salt in the ration 40, 20, 20, 17, 2 and 1 % respectively could be used along with the roughages source to make a complete feed block (Pandey 2014).

Wafering

Wafers are about ten times the size of pellets having sizes of rectangular wafers of 25X25 mm and cylindrical wafers of 8-30mm diameter. After milling and addition of concentrates, chemical additives and other minerals, the straw is wafered to increase the

nutrient value, intake and digestibility. The wafered feed is not only easy to transport, to store, and to feed, but also very convenient for marketing due to its high density. Wafers can be prepared from chopped straw alone or with 40 kg/ton molasses or with sodium hydroxide (Tingshuang et al 2002)

Role of rice by-products in livestock industries

Traditionally the major feed resources are crop residues and by-products, forest, seasonal grazing land, and non-cultivated areas. Agricultural land provide about 60% of the total annual feed supply, mainly in the form of low quality crop residues, whilst 40% comes from forest and grazing land (TLDP 2002). Crop residues constitute large parts of animal feeds in almost all ecological zones. Crop residues either processed or unprocessed dominates the ruminant feeding in Nepal. Approximately 40% TDN is supplied by crop residues. Rice straw meets about 32-37% of total digestible nutrients required for several million livestock units, especially during scarcity of green fodder (CDD 2015). Other residues or crop co-products include wheat straw, grain legumes, chunnis etc. In addition to stall feeding of :

Table 1: Ingredients used for animal and poultry feed formulation

SN	Feed ingredients	Quantity (M ton)	Inclusion %	Import %
1	Rice polish/bran	47,295	10.2	0
2	Deoiled rice bran	18,546	4.0	10
3	Wheat and wheat bran	38,485	8.3	0
4	Maize	194,742	42.0	45
5	Soybean meal	51,003	11.0	98
6	Others (Molasses, til cake, sunflower cake, mustard cake, fish meal, bone meal, oyster shell, limestone, feed supplements and additives)	113,601		Varies according to products
Total		463,672	100.0	

Note: The feed formula is only a typical example and it can vary between manufacturers depending upon the price and availability of feed grains. (Source: DMLP, 2008)

Industrial uses of rice by-products in livestock industries in Nepal

In the current scenario, there are about 120 registered feed company in Nepal. About 80% of egg production and 65% of broiler production cost goes to feed. At present, 92% of the total feed is used only for poultry, 5% and 3% for cattle and pig respectively (NFIA, 2012). The number of feed industries affiliated in

crop residues, animals are also grazed in the agricultural fields after harvesting of food/cash crops. This type of feed resource is temporary in nature and available for limited period but widely prevails all over the country (Yadav 2014). Rice polish (1.6 million M ton/year) is major energy source of rice by products available in Nepal. It provides energy of 3250 Kcal/Kg and 11% CP. Rice polish could be used as readily available energy source for rumen microbes while feeding urea treated rice straw for ruminant animals (Upreti and Shrestha 2006). Bastakoti et al (2009) and Upreti et al (2010) reported the average cost of milk production through feeding of rice straw and commercial feed was lower than concentrate based feeding and higher than forage based feeding.

Share of rice by-product in animal feed composition in Nepal

Rice polish, rice bran and rice straw are major sources of feeding materials for livestock in Nepal. Rice polish and rice bran constitute 10% and 6% in layer's and broiler's feed composition respectively. Rice bran shares maximum percent (30%) in cattle/buffalo feed composition as presented in the Table below

AEC/FNCCI has reached 94. The total of 2200 metric tons of feed per day is produced by Nepalese feed industries as poultry, cattle and pig feeds. The percent of use of rice by product like bran constitute around 10% (Silwal 2017, personal communication). Exact data regarding amount of rice bran and other such rice by-product in feed is lacking in recent years, however, amount of rice polish/bran and deoiled rice bran used

in livestock feed was 27,500 M tons and 10,784 M tons respectively in 2006 which increased to 47,295 M tons and 18,546 M tons in 2007 (DLMP 2008). Rice bran is generally used for feeding cattle and buffalo in Nepal. In Nepal, 5.9 kg and 22.5 kg bran is obtained that accounts of NRs. 107.50 and 409.95 (@NRs. 18.22 per kg) from 100 kg of milled white rice and brown rice, respectively (MRSMP 2013). Rice husk is generally used as bedding materials (litters) for poultry industries in Nepal. 24.50 kg of rice husk is extracted from 100 kg of paddy (MRSMP, 2013). A total of 1,173,209 M tons of husk is produced from 4,788,612 M tons of paddy at the rate of 24.5% husk recovery (MoAD 2015) annually amounting NRs. 5866.45 million at the rate of NRs. 5.0 per kg (Personal Communication DP Kaphle 2016).

Conclusion

Animal husbandry is chief occupation after crop production in Nepal. Rice straw is the major forage or residue which is used for animal feeding in small farms and bedding materials in winter. Farmers' preference to grow tall varieties with high straw yield is to provide feed to livestock. Rice bran and deoiled rice cakes are other rice by-products which are major part of commercial livestock feed. Adoption of technology like ensiling and urea treatment can enhance nutrient availability from otherwise less nutritive rice straw. Thus use of rice by-product in livestock industry has better prospect in Nepal.

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