



A Monthly e Magazine
ISSN:2583-2212
December, 2012

Online Popular Article

Azolla: Unconventional Feeds for Ruminant Feeding

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Introduction

Azolla is an unconventional feed and cheapest source of protein can be incorporated in the diets of ruminant up to 20% which enhance nutrients digestibility and animal performance. Also, several studies found that fresh Azolla can be used as feed supplement up to 2 kg/day/animal or as replacement dried Azolla up to 20% from commercial feed for dairy cows and buffalo which saved 15–20% of commercial feeds and increased milk production from 7 to 20%. We may conclude that employing Azolla in animal feeding improve animal performance and save feeding costs.

Chemical composition of Azolla

Chemical composition of Azolla was analyzed according to the methods of AOAC and it differs according to several factors and is almost the same between different authors. Chemical analysis of Azolla as estimated by: Samanta and Tamang (1995): 90.1% DM, 79.7% OM, 15.4% CP, 14.1% CF, 2.7% EE, 47.4% NFE, 20.4% Ash, 6.8% cellulose, 15.6% hemicellulose, 15.7% lignin, 16.0% silica, 0.35% phosphorus and 1.54% calcium.

Ahirwar and Leela (2012): 8.7% DM, 16–28% CP, 20–30% CF, 3.1% EE, 35.40% NDF and 23.97% ADF, 8.5–11.7% cellulose and low content of carbohydrates being 34.9%, and considered a rich source of micronutrients, 0.44% phosphorus, 0.58% calcium, 17.15 ppm copper, 77.30 ppm zinc, 207.8 ppm manganese and 710.65 ppm iron.

By continuous harvesting, high protein yields can be obtained from Azolla cultures, without the need for nitrogen fertilization. High levels of (poly) phenols likely contribute to limitations in the inclusion rate of Azolla in animal diets. Floating freshwater ferns from the genus *Azolla* as an alternative crop for the production of protein feed. A unique feature of *Azolla* ferns is that they host nitrogen (N_2) - fixing cyanobacteria, *Nostoc azollae*, in the cavities of their leaves. These



phototrophic symbionts fix N_2 during the day and likely release it as NH_4^+ in the leaf cavities to be taken up by the ferns. In feeding trials *Azolla* could be included in diets at rates of 10% for poultry, 15% for sows and 25% for tilapia fish, but higher inclusion rates negatively affected animal weight and overall digestibility, meaning that commercial soybean meal or fish feed could not be fully replaced by *Azolla*.

Use as an unconventional feed

Due to the scarcity of concentrate and green fodder and its high prices in animal feeding, the quest for readily available and inexpensive alternative sources has become critical for breeders seeking to minimize the cost of animal production. *Azolla* is an invasive plant that grows faster in freshwater lakes, rivers, wetlands, and ditches in both temperate and tropical countries by a few precautionary steps with low production costs. It can modify biodiversity and aquatic ecosystems substantially. *Azolla* has a symbiotic relationship with the nitrogen-fixing blue-green alga *Anabaena azollae*, which increases the protein content of *azolla*, making it one of the greatest alternative feed ingredients as a source of protein, with 25–30% protein, 7–10% amino acids, vitamins (Beta Carotene, vitamin A, vitamin B12), minerals (calcium, potassium, phosphorus, ferrous, magnesium, copper, etc.), and antioxidants.

Conclusion

Several studies showed that *azolla* can be fed to animals like cow, buffalo, sheep, goat and rabbit because it is easily digestible (because to its high protein and low lignin content), increases feed efficiency, average daily gain of animals, and milk production by 15–20%. In the diet of dairy cows, replacing 15–20% commercial feed with *Azolla* increased milk yield by 15–20%, this might be due to the low lignin and high protein content of *Azolla*. *Azolla* enhanced the growth rate compared with that of a diet containing rice straw alone. Thus, the possibility of using *azolla* as a source of alternative low-cost protein and its impact on animal efficiency.

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