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AZOLLA- AN ALTERNATE AND SUSTAINABLE FEED FOR LIVESTOCK

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Abstract: Azolla is very rich in proteins, essential amino acids, vitamins (vitamin A, vitamin B12, Beta Carotene), growth promoter intermediaries and minerals like calcium, phosphorous, potassium, ferrous, copper, magnesium etc. Azolla, on a dry weight basis, is constituted of 25-35% protein content, 10-15% mineral content and 7-10%, a combination of amino acids, bio-active substances and biopolymers. Carbohydrate and oil content in Azolla is very low. Thus the biocomposition of Azolla, makes it one of the most economic and efficient feed substitutes for livestock. Moreover, Azolla can be easily digested by livestock, owing to its high protein and low lignin content. Azolla can also be fed to sheep, goat, pig and rabbit as feed substitute.
Keywords: Azolla, Livestock, Feed stuff, Protein supplement.

Introduction

Feed additives have become essential component of feeds especially for poultry. The feed cost incurred about 60-65% of the total cost of poultry production and cost incurred about 13% of the total feed cost of the poultry production (Singh, 1990; Banerjee, 1992). Uses of antibiotics are not always good for poultry because of residual compounds that will ends with decreased productivity. Now phytogenic feed additives have gained increasing interest, especially for use in poultry to avoid the residual effects of synthetic drugs and to maintain the overall performance. The water fern Azolla (*Azolla pinnata*) is an unconventional feed ingredient. Azolla is a free floating fresh water fern belonging to the family Azollaceae and order Pteridophyta. Azolla is a potential feed ingredient for broilers. Azolla is rich in protein; total protein is 25-30%. Azolla can be used as a plant protein source and provitamins for poultry nutrition (Lejeunea *et al*., 1999). It is also a potential source of nitrogen and is a potential feed ingredient for livestock (Lumpkin, 1984). Azolla can increase flexibility of diet and makes possibility for cheaper production in poultry breeding and have been known as the cheapest and most abundant potential protein sources, because they are able to

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synthesize amino acids and a wide range of available and unlimited raw materials (Alalade and Iyayi, 2006).

Characteristics of Azolla

Azolla develops a symbiotic relationship with blue green algae, *Anabaena azollae*. An azolla plant is a fern frond consisting of a main stem growing at the surface of the water, with alternate leaves and adventitious roots at regular intervals along the stem. Secondary stems develop at the axil of certain leaves. Azolla fronds are triangular or polygonal and float on the water surface individually or in mats. Plant diameter ranges from 1⁄3 to 1 inch (1–2.5 cm) for small species, such as *Azolla pinnata*, to 6 inches (15 cm) or more for *A. nilotica*. A shallow fresh-water pond, similar to the environment found in a taro *lo'i*, is the ideal environment for azolla. When taro reaches maturity, it shades out the azolla below the canopy, gradually killing it and resulting in the release of nutrients into the soil-water system, where they become available for uptake by the taro plants.

Environmental requirements

Azolla is found in ponds, ditches, and wetlands of warm temperate and tropical regions throughout the world. It must grow in water or wet mud, and it dies within a few hours under dry conditions. Azolla can survive a water pH range of 3.5–10, but optimum growth occurs when the water is between pH 4.5 and 7. The optimum temperature for azolla is between 64 and 82□F (18–28^{0}C). The growth rate gradually declines as salinity increases. Azolla grows in full to partial shade (100–50% sunlight), with growth decreasing quickly under heavy shade. Azolla is established by vegetative propagation. Nursery ponds are generally used to supply a large enough volume to a wetland field to ensure quick coverage.

Azolla Production

1. An artificial water body is made, preferably under the shade of a tree, with the help of a silpauline sheet.
2. A pit of the size of 2M X 2M X 0.2M is dug as a first step.
3. This pit is covered with plastic gunnies to prevent the roots of the nearby trees piercing the silpauline sheet, which is spread over the plastic gunnies.
4. About 10 – 15 kgs of sieved fertile soil is uniformly spread over the silpauline sheet.
5. Slurry made of 2-kg cow dung and 30 gms of Super Phosphate in 10 litres water, is poured onto the sheet.
6. More water is poured to make the water level reach about 10 cm.
7. About 500 gms to 1kg of fresh and pure culture of Azolla is inoculated in the pit.

8. Azolla will rapidly grow and fill the pit within 10-15 days and about 500 gms – 600 gms of Azolla can be harvested daily thereafter.

9. A mixture of 20 gms of Super Phosphate and about 1 kg of cow dung should be added once in 5 days.

10. This is done to keep the Azolla in rapid multiplication phase and to maintain the daily yield of 500 gm /pit.

11. Micronutrient mix containing magnesium, iron, copper, sulphur etc., can also be added at weekly intervals to enhance the mineral content of Azolla.

Precautions

1. A shady place, preferably under a tree, with sufficient sunlight should be chosen for the Azolla production unit. A place of direct sunlight should be avoided.

2. All corners of the pit should be of the same level so that the water level can be maintained uniformly.

3. Azolla biomass @ 300 gms – 350 gms /sq.meter should be removed daily to avoid over crowding and for keeping the fern at rapid multiplication phase.

4. Suitable nutrients should be supplied, as and when, nutrient deficiency is noticed.

5. Plant protection measures against pests and diseases should be taken as and when required,

6. About 5 kg bed soil should be replaced with fresh soil, once in 30 days, to avoid nitrogen build up and prevent micro-nutrient deficiency.

7. 25 to 30% water also needs to be replaced with fresh water, once in 10 days, to prevent nitrogen build up in the bed.

8. Replacement of water and soil should be followed by fresh inoculation of Azolla, at least once in six months.

9. A fresh bed has to be prepared and inoculated with pure culture of Azolla, when contaminated by pest and diseases.

Harvesting

Azolla should be harvested with a plastic tray having holes of 1 sq.cm mesh size to drain the water. The tray along with Azolla should be kept in a bucket, half filled with water. Azolla should be washed to get rid of the cow dung smell. Washing also helps in separating the small plantlets which drain out of the tray. The plantlets along with water in the bucket can be poured back in to the original bed. Fresh Azolla thus collected should be mixed with commercial feed in 1:1 ratio to feed livestock. However, it is advisable to mix Azolla in

regular feed in 1:1 ratio at the beginning, for one week. After a fortnight of feeding on Azolla mixed with regular feed, livestock may be directly fed with Azolla, without the addition of regular feed material.

Nutritional composition of common Azolla species

Nutritional Content	***A.caroliniana***	***A.microphylla***	***A.pinnata***
Crude protein (%)	23.07	23.69	17.59
Crude fiber (%)	13.19	15.02	16.54
Total Ash (%)	29.17	28.71	25.28
Calcium (%)	2.07	2.07	1.67
Phosphors (%)	0.59	0.77	0.46
Iron (%)	0.269	0.249	0.231
Manganese (%)	0.238	0.274	0.205
Sodium (%)	1.240	0.488	0.777
Potassium (%)	2.44	4.93	2.19
Copper (ppm)	16.37	17.55	15.90
Zinc (ppm)	64.51	71.75	46.77
Magnesium (ppm)	0.15	0.173	0.155
Moisture (%)	5	5	5

As a livestock feed

The nutrient constitution of Azolla is found to be almost similar to that of commercial poultry feed, except that the protein content is high and calcium content is slightly low. There will be a substantial improvement in the quantity, as well as, quality of milk produced, when dairy cattle are fed with Azolla combined with commercial feed along with an improvement in the health of the cattle. The increase in the milk yield is to the tune of 10–15%, which went up to 20%, during summer months from February to May. It is found that the increase in the quantity of the milk produced on the base of nutrient was higher than the quantity of Azolla

fed. Hence, it is assumed that more than the carbohydrate, protein content and other components, like carotinoids, biopolymers, probiotics etc., may be contributing to the over all increase in the production of milk.

Conclusion

Azolla can be used as an ideal feed substitute for cattle, fish, pig and poultry, apart from its utility as a biofertilizer for wetland paddy. Azolla technology will be taken up in a big way by the dairy farmers, especially, by those who experience land scarce conditions for fodder production.

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