



EFFECT OF *Azolla*-SUPPLEMENTED FEEDING ON MILK PRODUCTION OF CATTLE AND PRODUCTION PERFORMANCE OF BROILERS

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ABSTRACT

Studies were conducted to explore the possibility of using *Azolla* (*Azolla pinnata*) as feed ingredient in cow and broiler ration. In 1st study, 60 cross-bred cows in their 2nd to 4th lactation were randomly divided into 2 groups and fed with or without *Azolla* supplemented commercial feed (1:1 :: *Azolla*: concentrate). *Azolla*-fed group showed a significant increase of 11.85% in milk production. In 2nd study, 220 one-day-old 'Vencobb' broiler chicks were divided into 2 groups and fed with commercial feed supplemented with or without dried *Azolla* meal [5% feed]. Result showed significant improvement in cumulative feed intake, body weight and FCR in broiler group fed with *Azolla*. The use of *Azolla* in cattle and broiler ration improved their production performance; so has a great potential as sustainable efficient feed supplement for cow and broiler (upto 5%).

Keywords: *Azolla*, broilers, cow, milk production, FCR, weight gain

INTRODUCTION

Azolla (*Azolla pinnata*), a floating water fern, is an unconventional feed ingredient as it is not accepted by most of the livestock owners. They consider it a noxious weed (Lumpkin *et al.*, 1980). Adaption of *Azolla* in India has been slow and sporadic due to poor yield, pest handling and storage difficulties and labour difficulties (Tamizhkumaran and Rao, 2012). It grows naturally in stagnant water of drains, canals, ponds, rivers and marshy lands (Basak *et al.*, 2002). It is most economic and efficient feed substitute for livestock and increases milk and meat production in animal (Pannaerker, 1988). *Azolla* is rich in protein, essential amino acids, carotinoids, vitamins, growth promoters and minerals (Basak *et al.*, 2002) and contains 20.0-25.5% protein, 3.1% fat, 34.9% carbohydrates, 8.5-11.7% cellulose and essential amino acids (Sithara and Kamalaveni, 2008). Carbohydrates and oil contents are very low in *Azolla*. High protein and low lignin content contribute for its high digestibility by livestock. *Azolla* can be mixed with commercial feeds in 1:1 ratio (2 kg each) for feeding livestock (Pillai *et al.*, 2005). *Azolla* may serve as a valuable protein supplement for many species (Hasan and Chakrabarti, 2009). Besides dairy animals, it may be supplemented in feed for sheep, goat, pig, rabbits and poultry. It increases body weight of broiler chicken (Singh and Subudhi, 1978; Basak *et al.*, 2002) and egg production of layers (Namara, 2000). In present scenario, the dairy farmers are dependent on commercial feeds, which are not economical for livestock production. Studies on *Azolla* supplementation in cattle and broilers are

scanty; therefore, the present experiments were aimed to assess the effects of *Azolla* feeding on production performance of cattle and broilers so that the possibility of *Azolla* as a low cost feed ingredient is explored.

MATERIALS AND METHODS

A study was conducted in 2012 on crossbred dairy cows ($n = 60$) in 2nd to 4th lactation for 12 weeks at Dongargaon block of district Rajnandgaon (Chhattisgarh). The culture of *Azolla* (*Azolla pinnata*) was obtained from Central Semen Station, Anjora, Durg and cultivated on large scale on UV stabilized silpauline sheets as described by Pillai *et al.* (2005). It was harvested at weekly interval and used for cattle feeding. After harvest, *Azolla* was dried and ground to make meal for feeding the broiler chickens. Sun-dried ground *Azolla* was analyzed for crude protein, ether extract, crude fiber, nitrogen free extract, ash, calcium and phosphorus on dry matter basis as per the standard methods AOAC, 1990).

A study was conducted on crossbred dairy (Sahiwal cross) cows ($n = 60$) in second to fourth lactation for 12 weeks at Dongargaon block of district Rajnandgaon, Chhattisgarh, India in January to March 2012. Animals were divided randomly into two equal groups; one group was fed with fresh *Azolla* in commercial feed @ 1:1 (1.5 kg *Azolla* + 1.5 kg concentrate). The other group was fed on commercial feed without *Azolla* supplementation. All the animals were monitored daily for milk yield during the period of supplementation. The animals were maintained under proper managemental conditions. Animals are kept in Pucca House. Individual cows were isolated by iron pipes. Separate feed mangers were provided. Animals were duly vaccinated and dewormed. Animals were milked twice daily (4 am and 4 pm) by full hand milking. Milk yield was measured by measuring cylinder and measuring flask. Record was maintained on register for individual cows.

In another study, 220 day-old Vencobb broiler chicks, owned by a self-help group, were divided equally in two. One group ($n = 110$) was supplemented with dried *Azolla* meal @ 5.0% commercial feed. The other group fed on feed without *Azolla* supplementation was taken as control. The broiler birds were reared on deep litter system following the proper managemental conditions for feeding, watering, vaccination and medication. Individual bird data was recorded. All the birds were monitored weekly for body weight gain against feed consumption upto 42 days. The data was statistically analysed using independent t-test (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The chemical analysis of sun-dried and ground *Azolla* showed that it contained 24.1% crude protein, 3.75% ether extract, 15.1% crude fiber, 40.25% nitrogen free extract, 16.8% ash, 2.18% calcium and 0.47% phosphorus on dry matter basis. The crude protein content of *Azolla* estimated in the present study closely agrees with Cherryl *et al.* (2014) and Balaji *et al.* (2009).

The result of experiment 1 milk yield of dairy cows fed with or without *Azolla*, recorded at 15 days interval was shown in Table 1. There was significant ($p < 0.01$) increase in milk production of dairy cows supplemented with fresh *Azolla*. The milk productivity started to increase after one week of *Azolla* supplementation, which further increased for next four weeks and thereafter it became constant at increased level. Milk yield increased by 11.85% after *Azolla* supplementation in dairy cows. All the treated animals were apparently healthy during the course of supplementation. There was no adverse effect on palatability of *Azolla* mixed feed for animals. The results of present study agreed with Pillai *et al.* (2005) who reported that fresh *Azolla* increased 10-15% milk

Table 1: Fortnightly milk production performance of cattle[#] fed with or without Azolla for 12 weeks

Milk production/ cow	Azolla treated group (L)	Control group (L)	Level of significance
0-15 day	118.98 ± 0.70 ^a	115.00 ± 0.06 ^b	**
15-30 day	127.18 ± 0.05 ^a	116.17 ± 0.02 ^b	**
31-45 days	131.21 ± 0.08 ^a	117.87 ± 0.13 ^b	**
46-60 days	131.22 ± 0.08 ^a	117.83 ± 0.09 ^b	**
61-75 day	130.60 ± 0.09 ^a	117.81 ± 0.10 ^b	**
76-90 day	130.50 ± 0.13 ^a	117.14 ± 0.10 ^b	**
Average	128.28 ± 0.08 ^a	116.97 ± 0.12 ^b	**

**P_{0.01}; # values shown in table is the average of many cattle (average of how many values)

production in dairy cattle and saved 20-25% of commercial regular feeds. Increase in milk production might be due to high protein and minerals content of Azolla with low lignin content that contribute for better digestibility and nourishment. Azolla is an efficient livestock feed and is rich in protein, essential amino acids, carotenoids, vitamins, growth promoters and minerals (Basak *et al.*, 2002). The observation in the present study is also in accordance with Khare *et al.*, (2014) who reported that when Azolla replaced mustard oil cake in lactating cow, there was significant (p<0.05) increase in milk yield. Present finding in the value of milk production is lower than the observation of Gauri *et al.*, (2012) who found it to be increased by 15-20%. According to Ambade (2010) there is milk yield increase by 15 to 20% after feeding of azolla in the diet of dairy cows and 15 to 20% commercial feed can be replaced with azolla. The profitability was comparatively higher in Azolla supplemented dairy cows due to significant higher milk yield against half replaced commercial feed. On weekly basis, each cow additionally produced 5.69-lit milk with saving of 10.5 kg commercial feed.

In broiler birds result showed that during the entire experimental period Azolla treated group (I) had significant improvement in cumulative feed intake, cumulative body weight and FCR as compared to control except feed intake in first week and body weight in third week Table 2). The present finding agree with Naghsi *et al.* (2014) who reported significant improved body weight and FCR compared to control when fed azolla @ 5% level. There was no adverse effect on palatability and weight gain in broiler birds supplemented with Azolla meal. These findings agreed with Basak

Table 2: Feed consumption body weights and feed conversion ratio of broiler# chickens fed with or with Azolla upto 42 days of age

Parameters	Days	Group I: Supplemented with Azolla	Group II: Without Azolla supplementation	Level of significance
Feed consumption (g bird ⁻¹)	0-7	179.72 ± 1.93	175.44 ± 1.95	ns
	0-14	561.62 ± 15.89 ^b	611.13 ± 15.63 ^a	*
	0-21	1167.73 ± 44.29 ^b	1275.93 ± 46.76 ^a	**
	0-35	3156.10 ± 25.52 ^b	3232.17 ± 25.28 ^a	**
	0-42	4185.26 ± 46.19 ^b	4316.39 ± 46.80 ^a	*
Body weight (g bird ⁻¹)	0-7	127.44 ± 2.48 ^a	121.83 ± 2.61 ^b	*
	0-14	376.84 ± 1.68 ^a	372.30 ± 1.69 ^b	*
	0-21	758.24 ± 0.90 ^a	757.85 ± 1.01 ^b	ns
	0-35	1725.36 ± 4.57 ^a	1710.43 ± 4.68 ^b	*
	0-42	2157.25 ± 3.62 ^a	2147.37 ± 3.15 ^b	*
Feed conversion ratio unit (g g ⁻¹)	0-7	1.42 ± 0.04	1.45 ± 0.03	ns
	0-14	1.49 ± 0.04 ^b	1.64 ± 0.04 ^a	**
	0-21	1.54 ± 0.06 ^b	1.68 ± 0.06 ^a	*
	0-35	1.83 ± 0.01 ^b	1.89 ± 0.01 ^a	**
	0-42	1.94 ± 0.02 ^b	2.01 ± 0.02 ^a	**

* (P_{0.05}); ** P_{0.01}); ns stands for non-significant;

values shown in table is the average of how many birds (average of how many values)

et al. (2002) who reported that feeding of dried *Azolla* up to 5% level does not negatively influence the cumulative body weight gain and feed consumption of broiler chickens. However, Bested and Morento (1985) reported that *Azolla* affected the palatability of the feed and reduced feed consumption. The survivability of birds was cent percent in *Azolla* treated group, which indicated that *Azolla* meal has no deleterious effect on broiler birds. Similar findings are reported by Castillo *et al.* (1981) and Basak *et al.* (2002). The overall performance of *Azolla* treated birds was significantly better than control group. It might be due to immunomodulatory effect of dried *Azolla* supplementation in broiler ration (Prabina and Kumar, 2010).

The average body weight per broiler bird was 1880.0 g against 3184.6 g total feed consumed in *Azolla* supplemented group compared to 1780.2 g body weight against 3176.5 g feed consumption in control group (Table 2). However, the feed consumption per bird was almost similar but output was higher in *Azolla* treated group due to 5% commercial feed replacement and cumulative higher body weight gain. For 100 broiler birds, the economic analysis revealed additional gaining of 9.98 kg body weight with saving of 15.92 kg commercial feed. Feeding *Azolla* to poultry birds improves the weight of the broiler chicken and increases the egg production in layers. The difference in findings might be due to either unbalanced feeding practices followed by the owner or change in local environmental condition. It can be concluded that *Azolla* as a feed can be used for feeding the cows and poultry in rural areas to reduce the production cost for attaining higher gain.

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REFERENCES

- Ambade, R.B., Jadhav, S.N. and Phalke, N.B. 2010. Impact of *Azolla* as a protein supplement and its influence on feed utilization in livestock. *Livestock Line*, **4**(4): 21-23.
- AOAC.1990. *Official Method of Analysis* (13th edn.). Association of Official Analytical Chemists, Washington, USA.
- Balaji, K., Jalaludeen, A., Churchil, R.R., Peethambaran, P.A. and Senthilkumar, S. 2009. Effect of dietary inclusion of *azolla* (*Azolla pinnata*) on production performance of broiler chicken. *Indian Journal of Poultry Science*, **44**: 195-198.
- Basak, B., Pramanik, M.A.H., Rahman, M.S., Tarafdar, S.U. and Roy, B.C. 2002 *Azolla* (*Azolla pinnata*) as a feed ingredient in broiler ration. *International Journal of Poultry Science*, **1**: 29-34.
- Bested, S.B. and Morento, S.E.1985. The effect of different percentage of *azolla* on fattening pigs. *MSAC Journal (Philippines)*, **17**: 31-40.
- Castillo, L.S., Gerpacio, A.L. and Paseual, F.S.D. 1981. Exploratory studies on *Azolla* and fermented rice hulls in broiler diets. *College Leguna (Philippines)*, pp. 6.
- Cherryl, D.M., Prasad, R.M.V., Rao, S. J., Jayalaxmi, P. and Srinivas D.K. 2014. A study on the nutritive value of *Azolla pinnata*. *Livestock Research International*, **2**: 13-15.
- Gauri-Mahadevappa, D., Sanganal-Jagadeesh, S., Gopinath, C.R. and Kalibavi C.M. 2012. Importance of *Azolla* as a sustainable feed for livestock and poultry - A review. *Agricultural Reviews*, **33**: 93-103.
- Hasan, M.H. and Chakrabarti, R. 2009. *Use of Algae and Aquatic Macrophytes as Feed in Small-scale Aquaculture - A Review*. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Khare, A., Baghel, R.P.S., Gupta, R.S., Nayak, S., Khare, V., Patil, A., Sharma, R., Tomar, R. and Singh V.P. 2014. Milk production of indigenous cattle fed supplements of mustard oil cake or

- azolla meal (*Azolla filiculoides*). *Livestock Research for Rural Development*, **26**(4): Article # 65. Retrieved August 12, 2015; <http://www.lrrd.org/lrrd26/4/khar26065.html>
- Lumpkin, T.A. and Plucknett, D.L. 1980. Azolla: Botany, physiology and use as a green manure. *Economic Botany*, **34**: 111-153.
- Naghshi, H., Khojasteh, S. and Jafari, M. 2014. Investigation on the effect of different levels of azolla (*Azolla pinnata*) on performance and carcass characteristics of Cobb broiler chicks. *International Journal of Farming and Life Sciences*, **3**: 45-49.
- Namra, M.M. 2000. *Fresh and Dried Azolla as a Feedstuff for Broilers and Layers*. PhD thesis. Animal Production Research Institute (APRI), Dokki, Giza, Egypt.
- Pillai, P.K., Premalatha, S. and Rajamony, S. 2005..Azolla: A sustainable feed for livestock. *LEISA India*, **21**(3): 26-27.
- Pannaerker, S. 1988. Azolla as a livestock and poultry feed. *Livestock Advisor*, **13**: 22-26.
- Prabina, B.J. and Kumar, K. 2010. Azolla as a nutritionally rich cost effective and immunomodulatory feed supplement for broilers. *Asian Journal of Animal*, **5**: 20-22.
- Singh, P.K. and Subudhi, B.P.R. 1978. Utilisation of Azolla in poultry feed. *Indian Farming*, **27**: 37-39.
- Sithara, K. and Kamalaveni, K. 2008. Formulation of low-cost feed using azolla as a protein supplement and its influence on feed utilization in fishes. *Current Biotica*, **2**: 212-219.
- Snedecor, G.W. and Cochran, W.G. 1994. *Statistical Methods* (8th edn.). Iowa State University Press, Ames, Iowa, USA.
- Tamizhkumaran, J. and Rao, S.V.N. 2012. Why cultivation of Azolla as cattle feed not sustainable? *Indian Journal of Dairy Science*, **65**: 348-353.