

Effect of *Azolla* supplementation on milk yield and economics under farmers' field

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ABSTRACT

Productivity of dairy animals largely depends on efficient feeding management. Balanced and proper feeding results in better utilization of nutrients and optimum milk production. Farmers generally fed their milch cows through grazing without considering quality and quantity of concentrate feed in Murshidabad District of West Bengal. Traditional supplements based on mustard oil cake as concentrate feed cannot fulfill the required nutrients to animals. There is ample scope for improving the productivity of livestock by better balancing of nutrients and optimizing the utilization of unconventional feed resources. *Azolla* has been reported as potential feed supplement for milch animals, which have rich in protein, essential amino acids, vitamins and minerals. Feeding of *Azolla* to milch animals resulted in increase in milk yield. The low cost supplementation of *Azolla* can also improve the mean returns from single cow (through additional milk yield) per month in the village.

Keywords: *Azolla*, desi cows, economics, feed supplement, milk production

Ruminants play a major role in providing nutritional and livelihood security for millions of rural households in India. Among many factors governing the livestock productivity, feeding accounts for more than 60-70 per cent of the total recurring cost and hence qualitative and quantitative improvement in this aspect will usually improve productivity. Conventional sources of feeds are not enough to mitigate the shortage of feeds and fodder and to make animal production viable and profitable in tropical countries. India had 70 million hectares under grassland in the year 1947 has reduced to 38 million hectares today. As a result, the net deficit of green fodder is around 60 per cent, apart from the feed deficit of around 64 per cent. In order to bridge this gap and to ensure optimum production of livestock throughout the year, we have to make greater use of unconventional feed resources as supplement or replacement of conventional feed, but without compromising the quality of nutrient supply. Many researchers (Khutan and Ali, 1999; Satish and Ustuge, 2009; Tamang and Samanta, 1993) have identified many unconventional feed and fodder to maintain the milk production particularly in off season. The search of alternatives to green fodder and concentrates led to a wonderful plant *Azolla*, which holds the promise of providing a sustainable feed for livestock. *Azolla* has attracted the attention of scientists as a feed resource for livestock and even called it as Green gold mine or super plant due to its high nutritive value and faster growth. *Azolla* is a small free floating aquatic fern. *Azolla* is rich in protein, minerals, amino

acids, vitamins and growth promoting intermediates. Its nutrients composition makes it an efficient and ideal feed supplement for livestock, poultry, pigs and fish (Lumpkin, 1984). Though a few sporadic reports on effect of *Azolla* are available, a large scale study under field condition is lacking. Thus, a field level investigation was carried out to study the effect of feeding *Azolla* on milk yield and economics in 8 villages of Murshidabad district of West Bengal. The study villages have a sizeable population of desi cows with very low milk yield i.e. 2 to 4 liters per cow per day.

MATERIALS AND METHODS

The present study was carried out in 2013-14 and 2014-15 by establishing 56 *Azolla* production units of 8×5×0.66 feet size with silpaulin sheet and mesh covering in 8 adopted villages spread across Bhagwangola-I, Bhagwangola-II and Murshidabad-Jiaganj block of Murshidabad district, West Bengal by Scientists of Murshidabad Krishi Vigyan Kendra, West Bengal University of Animal And Fishery Sciences. The livestock owners were properly trend by hands on training on *Azolla* production technology, according to Kamalasanana *et al.* (2002). Farmers could harvest *Azolla* @ 1kg per day (mean fresh weight) from each unit. Harvested *Azolla* was thoroughly washed with fresh water to remove the smell of dung and it was fed to animal along with concentrates. Regular monitoring was done and suggestions were given by KVK scientists to rectify the problems arise in *Azolla* cultivation under

different villages, where *Azolla* production units were established and an On Farm Trail (OFT) was conducted to study the effect of *Azolla* on cow's milk yield and its economics. The *Azolla* samples were collected from different villages and their nutrient content was analyzed according to analytical procedure suggested by A.O.A.C. (Anon., 1990).

For this purpose initially 56 lactating desi cows of second to third lactation of 5 to 7 years old at mid lactation were selected from 8 adopted villages. As seven *Azolla* units could not be continued due to water quality problems, final data was recorded from 49 desi cows. The cows were hand-milked twice daily. Daily milk yield of each animal was recorded for a period of 70 days. During the trial daily milk yield were recorded and physical health status of animals were observed. For comparison, daily milk yield was computed by averaging the weekly milk output after 28, 49 and 63 days of *Azolla* feeding. The economics were worked out by using the prevailing milk price of Rs. 23/- per litre during the study period. Benefit Cost ratio (B:C ratio) was worked out by following formula:

$$\text{BCR} = \frac{\text{Additional returns} - \text{Additional cost}}{\text{Additional cost}}$$

The data were statistically analyzed in IBM SPSS version 23.0.

RESULTS AND DISCUSSION

Chemical composition of *Azolla* is indicated from the table 1 that the dry matter, crude protein and crude fibre content were 9.03, 22.65 and 11.03 percent respectively. Moreover, the ether extract, nitrogen free extract and ash percentage were 2.02, 42.12 and 24.7 respectively. Thus, it can be concluded from table 1 that *Azolla* is reasonably good source of energy and high source of protein for the animal. Kumar *et al.* (2012) found that the CP, EE, CF, NFE and ash content of *Azolla* were 22.5, 2.36, 15.2, 33.8 and 26.1 per cent respectively. Variations in the nutrient composition are possible due to the environmental conditions like nutrition, light intensity etc. (Giridhar *et al.*, 2012).

In the present study, *Azolla* supplementation in the diet for 28 days and 49 days increases milk yield of desi cows by over 0.61 litre and 0.80 litre per day on an average, resulting in an additional daily income of Rs. 14.03/- and Rs. 18.40/- per cow respectively (Table 2). Similarly, *Azolla* supplementation for 63 days improved mean daily milk production from each cow by 0.95 litre approx and the returns by Rs. 21.85/-. The milk yield improvement was most probably due to supplementation of essential amino acids and huge protein through *Azolla*. Sanginga and Van Hove (1989) stated that the main

character influencing the value of *Azolla* as its feed is its amino acids composition. Pillai *et al.* (2002) also reported that substantial improvement in the quantity (15-20%) and quality of milk produced when livestock were fed fresh *Azolla* @ 1.5 to 2 kg day⁻¹ animal⁻¹. About 20.22 per cent increase in the milk yield is a tremendous improvement. It is in conformation with Singh *et al.* (2017); Mathur *et al.* (2013) and Kamalasanana *et al.* (2002) in buffaloes. Whereas, Kololgi *et al.* (2009) reported 10 per cent increase in milk yield in lactating buffaloes. Gouri *et al.* (2012); Ambade *et al.* (2010); Rawat *et al.* (2015) and Gowda *et al.* (2015) found similar results in cross bred cows. In different studies it was revealed that the *Azolla* can be fed to the animals without any adverse effects. In this study, *Azolla* has not only increased the milk yield but also increased in physical health status and reproductive efficiency of animal.

Table 1: Chemical composition of *Azolla* (n = 8) fed to desi cows (percent on dry matter basis)

Sl. No	Attributes	Content (%)
1	Dry Matter	9.03
2	Crude Protein	22.65
3	Crude Fibre	11.03
4	Ether Extract	2.02
5	Nitrogen Free Extract	42.12
6	Ash	24.7

Table 2: Effect of *Azolla* supplementation on average milk production and income

Period	Milk yield (litres day ⁻¹)	Returns per day from milk sale (₹)
Initial (base level)	2.38 ^a	59.70 ^a
28 days of feeding	2.99 ^a	68.66 ^a
49 days of feeding	3.18 ^b	73.14 ^a
63 days of feeding	3.33 ^b	79.93 ^b
SEM	0.13	3.15
Sig. (P value)	0.077	0.168

Note: ^{ab}Means bearing similar superscripts doesn't differ significantly (P < 0.05) column-wise

Milk production varied among different villages under studied, with the minimum milk yield increment of 0.61 litre per day after 70 days of *Azolla* feeding in Balarampur village under Bhagwangola block-I. Maximum mean daily milk yield increase of 1.09 litre was recorded in Beliapukur village under Murshidabad-Jiaganj block. A similar trend was observed in daily economic returns. These yield variations were mainly due to the differences in the production potential of cows and feeding practices adopted by the farmers. General

Table 3: Partial budgeting to access benefits of *Azolla* feeding to desi milch cows (₹ per cow)

S. No	1. Debit side	₹	2. Credit side	₹
1	Additional cost:			
	a) Digging charges of pond (size of unit 8 × 5 × 0.66 ft)	Family labour		
	b) Cost of silpauline sheet	445.00		
	c) Nylon Shady net	620.00		
	d) <i>Azolla</i> 30 kg @ ₹ 7 kg ⁻¹	210.00	Reduced cost:	0
	e) Cow dung	Available with farmers		
	f) Super phosphate 840 gms. @ 70 g ⁻¹ month ⁻¹	11.20		
	Total Additional cost:	1286.20		
2	Reduced returns:	0	Additional returns: Due to extra milk yield and 260 days of lactation period with <i>Azolla</i>	
		5382.00		
	Total	1286.20	Total	5382.00
Net Gain: (2-1) = (5382.00 – 1286.20) = ₹ 4095.80				
Benefit Cost Ratio (BCR): = 3.18:1				

feedback of the farmers was that the animal starts showing excellent sign of health such as improved hair coat condition, brightness in eyes, moist muzzle and always activeness after feeding of *Azolla*.

Generally, the cows were sent for grazing with supplementation being highly variable and difficult to quantify. In the experimental villages on an average the per day milk yield of desi cows enhance from 2.38 to 3.33 litres, an increase of 0.95 litre per cow with the supplementation of *Azolla*. This low cost *Azolla* supplementation improved the mean returns from a single cow, through milk sale, by ' 655.50/- per month in the villages. Partial budgeting was done to access the impact of *Azolla* (Table 3). It showed that the farmer by investing just ' 1286.20/- on *Azolla* production can earn additional returns of ' 5382/- per dairy cow. The B: C ratio was calculated to be 3.18:1, indicating high income utility of this *Azolla* supplemental feeding.

The supplemental feeding of fresh green *Azolla* has positive effect on the milk production and economics. Therefore, it can be used as a valuable green feed supplement for lactating cows, particularly under low input livestock production system, where livestock owners fed only unbalanced concentrate ration, because the only single oil cake or unbalanced concentrate ration cannot fulfill the nutrient requirement of animal. Through feeding of *Azolla* can produce more milk from desi cows under field condition in Murshidabad district of West Bengal. The low cost supplementation of *Azolla* can also improve the mean economic returns from single cow (through additional milk yield) per month in the village.

Farmers felt that the technology is highly useful because of easy to adopt and the results are also visible within a short period of time. It is concluded that the improvement in health and physical condition of animals and also increase in milk yield particularly, motivated the farmers towards *Azolla* cultivation.

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