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## Effect of *Azolla (Pinnata)* supplementation on the growth performance of Deccani ram lambs reared under grazing based production system

**Thejavath Varun Singh, Rayavarapu Maruthi Vara Prasad, Punnavajjala Jayalaxmi, Mudavath Sandhya Rani, Allu Teja and Bukke Triveni**

### Abstract

A study was conducted using 18 weaner ram lambs to study the effect of *Azolla pinnata* supplementation on growth characteristics of lambs reared under grazing based production system of Mahabubnagar district of Telangana state. Duration of experimental feeding was 120 days. Azolla, the super plant with high protein and nutritive value may meet the nutritional demand of Deccani sheep and may help in gaining optimum body weight at an early age in grazing system of management. Azolla was cultivated in pits, harvested every week, and shade dried. The lambs were divided in to three experimental groups i.e., T1, T2 and T3 with six lambs in each group, such that average group weights were uniform. T1 group was control with no azolla supplementation while in T2 and T3, azolla was supplemented at the rate of 10 and 20% of dry matter intake, respectively. The study revealed that the cumulative weight gains over a period of 4 months were 8.47±0.12 kg, 10.76±0.09 kg and 13.04±0.07 kg in Deccani ram lambs fed 0, 10 and 20% of azolla on dry matter requirement basis, respectively, and the difference between the groups were significant ( $p < 0.01$ ). The average daily gain in ram lambs fed with 0, 10 and 20% of azolla on dry matter requirement basis was 70.57±1.59, 89.67±1.27 and 108.62±3.56 g, respectively. The study revealed that the supplementation of dried azolla meal upto 20% produce higher body weights at early age which is a good indication for early slaughter age.

**Keywords:** Deccani ram lambs, early slaughter age, grazing system of management, growth performance, shade dried Azolla

### 1. Introduction

India is the most populous country with rapid increase in the urbanization. The migration from the rural areas to urban areas and consequent increase in the demand for quality food due to increased purchasing power is leading to a pressure on production and productivity on unit basis. The quality consciousness is leading to an increased demand for protein rich foods especially the meat-based products which ensure food security and livelihood to a large population. India possesses 74.26 million sheep (DAHD, 2019) [5]. Sheep form an important component of rural economy by providing a dependable source of income through the sale of meat, wool and skin. Deccani sheep are native to Telangana and greatly contribute to places of poor agricultural practice which helps in economic support to the farmers. Deccani sheep are low grade in wool quality reared chiefly for mutton production and have the ability to grow in extreme weather conditions and are less susceptible to diseases. The majority of the farmers of Telangana follow the traditional practice of an extensive rearing system in which inputs of nutrient are very much minimal. Though the sheep play an important role, they are largely reared with low external inputs in grazing-based production systems. The unavailability of nutrients through grazing makes the animal nutrient imbalanced, especially proteins, thereby causing delayed maturity and poor growth rates. These poor growth rates will make the animals take more time to reach the market which in turn delay the realization of income. Moreover, Deccani sheep are hardy and have the potential to grow fast, if they are provided with some supplementation in the form of protein and required nutrients. In this context, a feed material that is good in nutrients, and require less space with fast growth is needed to meet the growing feed demand in turn to compensate the land constraint. *Azolla pinnata* (unconventional feed) appears to be a potential source of nutrients and has a considerably high feeding value as it contains almost all essential amino acids specially lysine and minerals such as iron, calcium, magnesium, potassium, phosphorus, manganese, and also appreciable quantities of vitamin A precursor beta carotene and vitamin B12 (Leterme *et al.*, 2010) [11]. It also found to contain probiotic and bio polymers (Pillai *et al.*, 2002) [12].

The incorporation of Azolla in weaner lambs ration had no adverse effects on carcass traits (Wadhvani *et al.*, 2010) [20]. Azolla, the super plant with high protein and nutritive value may meet the nutritional demand of Deccani sheep and may help in gaining optimum body weight at an early age in grazing system of management.

## 2. Materials and Methods

### 2.1 Location of Research

The Experiment was conducted in the year 2019 at Livestock Research Station (LRS), PVNR Telangana Veterinary University, Mahbubnagar district, Telangana.

### 2.2 Design of the Experiment

The study was conducted for 120 days using 18 weaner ram lambs of 3- 4 months of age fed with azolla meal as a whole feed supplement. The lambs were divided into three experimental groups (T1, T2, T3) with six weaner lambs in each group such that the group average weights were uniform. The ram lambs of T1, T2 and T3 groups were allowed to graze daily as common practice from 9:00 AM to 4:00 PM. After grazing, azolla was given as whole feed supplement at 10% and 20% of dry matter (DM) requirement to the T2 and T3 groups, respectively and no azolla was supplemented to T1 group which was taken as a control to the experiment.

### 2.3 Cultivation, Harvest, shade dried and storage of azolla

Three pits for the cultivation of azolla were designed at LRS, PVNR Telangana Veterinary University, Mahbubnagar, Telangana. Each pit with a dimension of 5 m X 4 m (20 m<sup>2</sup>) was made with 0.3 m depth (1ft). Azolla multiplied rapidly and filled the pits within a week and the fully grown azolla was harvested every week from the three pits, washed thoroughly in clean water, weighed and shade dried for 2 to 3 days making it crispy while retaining green color in the dried azolla. Shade dried azolla was collected, packed and stored in gunny bags until further use.

### 2.4 Recording the body weights

The selected Ram lambs for the experiment were weighed every fortnightly before the lambs were allowed for grazing in the morning i.e., before 9.00 AM. The lambs were weighed using digital weighing machine at LRS. The average daily gain (ADG) was calculated for the lambs at every fortnight interval. The final body weight and cumulative weight gain of all the experimental lambs were calculated at the end of the research and compared between the treatments for the analysis of the growth performance.

### 2.5 Statistical analysis

The data was subjected to the standard statistical procedure (Snedecor and Cochran, 1994) [18] to compare the means of different treatment groups.

## 3. Results and Discussion

### 3.1 Fortnight body weights

Average body weights at fortnight intervals of weaner ram lambs are presented in Table 1 and the pattern of variation in fortnight body weight of three treatments were shown in Fig 1. The results indicated that on the first day of the experiment the mean body weights (kg) were 10.51±0.43, 10.50±0.44 and 10.50±0.42 in the three treatment groups T1, T2 and T3 respectively. The first and second fortnight mean body weights were 11.64, 11.78 and 11.95 kg and 12.76, 13.09 and 13.42 kg for the groups T1, T2 and T3, respectively. The third fortnight mean body weights were 13.82, 14.41 and 14.93 kg for the groups T1, T2 and T3, respectively. The fortnight means body weights of first, second and third were non-significant between the means of T1, T2 and T3. The fourth and fifth mean body weights of T1, T2 and T3 were 14.90, 15.72 and 16.51 kg and 15.97, 17.06 and 18.17 kg respectively, with significant difference between the means. The sixth and seventh fortnight mean body weights were 17.06, 18.41 and 19.90 kg and 18.04, 19.81 and 21.69 kg for the groups T1, T2 and T3, respectively with significant difference between the means. The mean fortnight body weight of deccani ram lambs at eighth fortnight (final body weight) in treatment groups of T1, T2 and T3 were 18.98±0.41, 21.26±0.40 and 23.54±0.36 kg, respectively and were statistically significant. The cumulative weight gain (kg) in ram lambs of T1, T2, and T3 groups after a period of 16 weeks were 8.47±0.12, 10.76±0.09 and 13.04±0.07, respectively (Table 2). The total weight gain was significantly higher in the treatment T3 group followed by T2 and T1 group indicating that inclusion of azolla as protein replacement upto 20% of DM requirement based on bodyweight shows an early weight gain of the lambs. This is in agreement with the findings of Kumari (2015) [10] who reported that the black Bengal goat kids fed with azolla as a part of protein replacement upto 20% level in concentrate diet gained significantly more body weight. These observations were similar to the observations of Reddy (2013) [13] who reported that the goat kids gained more body weights in T3 group where 30% GNC protein replaced with azolla. Similarly, the findings of Toradmal *et al.* (2017) [19] who reported significant increase in final body weight with inclusion of fresh azolla upto 300 g under intensive system. Ahmed *et al.* (2016) [11] observed that replacing 25% linseed cake by 6% azolla in the diets of Corriedale sheep increased body weight. Improved weight gain also reported by Basak *et al.* (2002) [2], Bhattacharyya *et al.* (2016) [4], Kumar *et al.* (2018) [8], Sinha *et al.* (2018) [17] in poultry birds. From the results of present study, it is clearly understood that the inclusion of azolla as a supplementation improve the body weights at an early age, so that the farmers get benefitted as they can dispose their animals at an early age instead of keeping them for long.

**Table 1:** Effect of azolla supplementation on the fortnightly mean body weights (kg) of Deccani ram lambs

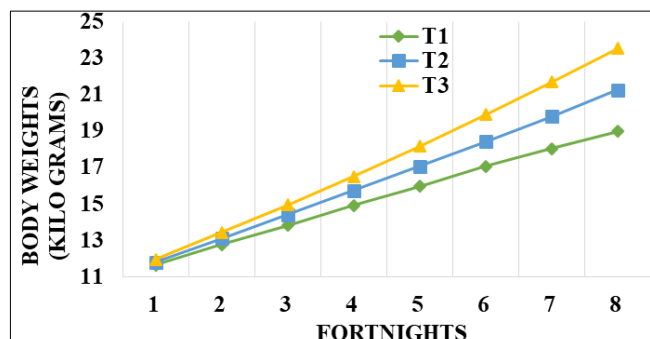
Treatment	Initial body weights	Fortnights							Final body weight
		F1	F2	F3	F4	F5	F6	F7	
T1 (0%)	10.51±0.43	11.64±0.43	12.76±0.43	13.82±0.43	14.90 <sup>a</sup> ±0.42	15.97 <sup>a</sup> ±0.42	17.06 <sup>a</sup> ±0.41	18.04 <sup>a</sup> ±0.42	18.98 <sup>a</sup> ±0.41
T2 (10%)	10.50±0.44	11.78±0.43	13.09±0.43	14.41±0.42	15.72 <sup>ab</sup> ±0.42	17.06 <sup>ab</sup> ±0.42	18.41 <sup>b</sup> ±0.41	19.81 <sup>b</sup> ±0.41	21.26 <sup>b</sup> ±0.40
T3 (20%)	10.50±0.42	11.95±0.41	13.42±0.41	14.93±0.40	16.51 <sup>b</sup> ±0.39	18.17 <sup>b</sup> ±0.39	19.90 <sup>c</sup> ±0.38	21.69 <sup>c</sup> ±0.37	23.54 <sup>c</sup> ±0.36

a, b, c Means with different superscripts columns wise differ significantly ( $p < 0.01$ )

**Table 2:** Effect of azolla supplementation on mean final bodyweight (kg), mean weight gain (kg) and average daily gain (g) of Deccani ram lambs

Treatments	Initial body weights	Final body weights	Cumulative weight gain	Average daily gain
T1 (0%)	10.51±0.43	18.98 <sup>a</sup> ±0.41	8.47 <sup>a</sup> ±0.12	70.57 <sup>a</sup> ±0.97
T2 (10%)	10.50±0.44	21.26 <sup>b</sup> ±0.40	10.76 <sup>b</sup> ±0.09	89.67 <sup>b</sup> ±0.73
T3 (20%)	10.50±0.42	23.54 <sup>c</sup> ±0.36	13.04 <sup>c</sup> ±0.07	108.62 <sup>c</sup> ±0.58

a, b, c Means with different superscripts columns wise differ significantly ( $p < 0.01$ )

**Fig 1:** Fortnight average body weight pattern in Deccani Ram lambs

### 3.2 Fortnight average daily gain (ADG)

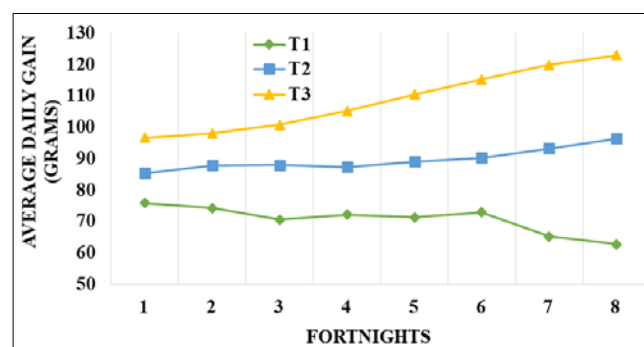
The fortnight average daily gain (ADG) in weaner ram lambs of T1, T2, and T3 when fed 0%, 10% and 20% azolla on DM basis, respectively are presented in Table 3 and variation pattern of ADG was shown in Fig 2. The first fortnight means of ADG for the groups T1, T2, and T3 were 75.78, 85.33 and 96.67 g, respectively. The second and third fortnight mean ADG were 74.22, 87.78 and 98.00 g and 70.56, 87.89 and 100.67 g for the groups T1, T2 and T3, respectively. At the end of the fourth fortnight, the observed mean ADG was 72.11, 87.33 and 105.11 g for lambs in treatment T1, T2, and T3, respectively. For the fifth and sixth fortnight mean ADG was 71.22, 89.11 and 110.45 g and 72.89, 90.33 and 115.22 g for lambs of T1, T2 and T3 groups, respectively. It was found that the seventh and eighth fortnights mean ADG was 65.11, 93.22 and 119.89 g and 62.67, 96.45 and 123.00 g for the lambs under T1, T2 and T3 groups, respectively. Mean fortnight ADG of T3 was highest with 108.62 g, followed by T2 with 89.67 g and T1 with 70.57 g. From the results of the present study, it was observed that mean ADG was higher in T3 (108.62 g/day) when compared to T2 (89.67 g/day) and T1 (70.57 g/day) while the difference between the means were statistically significant. Jyoti *et al.* (2016) [7] revealed that the replacement of concentrate feed by 20 and 30% dried azolla increased the average daily gain of goats by 56.5 and 60%, respectively. Sharma *et al.* (2021) [15] concluded that azolla improved the growth performance of male goat kids when supplemented by 150, 250 and 350 gm to concentrate diet such ADG increased by 21.13, 29.34 and 22.59%, respectively, compared with no azolla supplement. Bhatt *et al.* (2021) [3] reported that 15% replacement of concentrate with azolla increased ADG of female calves. Dev *et al.* (2022) [6] inferred that the supplementation of sun-dried Azolla meal (@ 10% replacement of concentrate feed improved the performance of Sirohi goat kids in terms of ADG. The results obtained were similar to that reported by Reddy (2013) [13], Toradmal *et al.* (2017) [19], Kumar *et al.* (2017) [9] in goat kids, but contrary to the reports of Wadhvani *et al.* (2010) [20], Shekh *et al.* (2016) [16] when azolla was included in TMR rations of lambs; Sankar *et al.* (2020) [14] when 10% protein of concentrate mixture was replaced by dried azolla meal on DM basis in Mecheri sheep. The significant variations in the

results of ADG in present study may be attributed that azolla was palatable and observed high feed intake which ensures the optimum absorption of nutrients resulted in early weight gain of the lambs which is economically beneficial to shepherds.

**Table 3:** Effect of azolla supplementation on fortnightly average daily gain (g) of Deccani Ram lambs

Fortnights	Azolla supplementation		
	T1 (0%)	T2 (10%)	T3 (20%)
F1	75.78 <sup>a</sup> ±1.76	85.33 <sup>b</sup> ±1.09	96.67 <sup>c</sup> ±0.86
F2	74.22 <sup>a</sup> ±0.80	87.78 <sup>b</sup> ±1.28	98.00 <sup>c</sup> ±0.71
F3	70.56 <sup>a</sup> ±1.08	87.89 <sup>b</sup> ±0.99	100.67 <sup>c</sup> ±0.97
F4	72.11 <sup>a</sup> ±1.94	87.33 <sup>b</sup> ±0.60	105.11 <sup>c</sup> ±0.66
F5	71.22 <sup>a</sup> ±0.76	89.00 <sup>b</sup> ±1.85	110.45 <sup>c</sup> ±0.59
F6	72.89 <sup>a</sup> ±1.49	90.33 <sup>b</sup> ±0.48	115.22 <sup>c</sup> ±0.47
F7	65.11 <sup>a</sup> ±0.72	93.22 <sup>b</sup> ±1.02	119.89 <sup>c</sup> ±1.25
F8	62.67 <sup>a</sup> ±0.77	96.45 <sup>b</sup> ±1.08	123.00 <sup>c</sup> ±0.86
Mean ADG±SE	70.57 <sup>a</sup> ±1.59	89.67 <sup>b</sup> ±1.27	108.62 <sup>c</sup> ±3.56

a, b, c Means with different superscripts in a row differ significantly ( $p < 0.01$ )

**Fig 2:** Fortnight average daily gain (ADG) pattern in Deccani Ram lambs

## 4. Conclusion

The study revealed that the supplementation of shade dried azolla meal as a protein feed supplement upto 20% of DM requirement on bodyweight basis under grazing based production system produce higher body weights at early age which is a good indication for early slaughter age and economically beneficial to the sheep rearing farmers.

## 5. Acknowledgement

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## 6. Conflict of Interest

There is no conflict of interest.

## 7. References

- Ahmed HA, Ganai AM, Beigh YA, Sheikh GG, Reshi PA. Performance of growing sheep on Azolla based diets.

- Indian Journal of Animal Research. 2016;50(5):721-724.
2. Basak B, Pramanik MAH, Rahman MS, Tarafdar SU, Roy BC. Azolla (*Azolla pinnata*) as a feed ingredient in broiler ration. International Journal of Poultry Science. 2002;1(1):29-34.
  3. Bhatt N, Tyagi N, Chandra R, Meena DC, Prasad CK. Growth performance and nutrient digestibility of *Azolla pinnata* feeding in sahiwal calves (*Bos indiens*) by replacing protein content of concentrate with *Azolla pinnata* during winter season. Indian Journal of Animal Research. 2021;55(6):663-668.
  4. Bhattacharyya A, Shukla PK, Roy D, Shukla M. Effect of Azolla supplementation on growth, immunocompetence and carcass characteristics of commercial broilers. Journal of Animal Research. 2016;6(5):941-945.
  5. DAHD, 2019. Provisional key results of 20th Livestock census. Retrieved from <http://dadf.gov.in/sites/default/files/Key%20Results%2BAnnexure%2018.10.2019.pdf>.
  6. Dev R, Nanavati S, Jamra MS, Patil AK. Performance of Growing Sirohi Goats on Azolla (*Azolla Pinnata*) Based Diet. Indian Journal of Veterinary Sciences & Biotechnology. 2022;18(1):107-109.
  7. Jyoti A, Ingole AS, Atkare VG, Rohini D, Patil AA. Effect of Azolla (*Azolla pinnata*) feeding on growth performance of Osmanabadi goat kids. Journal of Soils and Crops. 2016;26(1):162-165.
  8. Kumar K, Dhuria RJ, Jain D, Sharma T, Nehra R, Gupta L, *et al.* Effect of Supplementation of Azolla on the Hematology, Immunity and Gastrointestinal Profile of Broilers. International Journal of Livestock Research 2018;8(09):184-191.
  9. Kumar R, Tripathi P, Chaudhary UB. Influence of Feeding Azolla Containing Complete Pellet Feed on Performance of Goat Kids. Indian Journal of Animal Nutrition. 2017;34(2):229-232.
  10. Kumari J. To study the effect of different level of azolla meal on nutrient utilization and growth performance in goat kids. M.V.Sc. Thesis submitted to Bihar Agricultural University, Patna; c2015.
  11. Leterme P, Londoño AM, Ordoñez DC, Rosales A, Estrada F, Bindelle J, *et al.* Nutritional value and intake of aquatic ferns (*Azolla filiculoides* Lam. and *Salvinia molesta* Mitchell.) in sows. Animal Feed Science and Technology. 2010;155(1):55-64.
  12. Pillai KP, Premalatha S, Rajamony S. Azolla-A sustainable feed substitute for livestock. Leisa India. 2002;4(1):15-17.
  13. Reddy DS. Effect of feeding azolla (*Azolla pinnata*) based concentrate mixtures on growth and nutrient utilization in growing kids. M.V.Sc. Thesis submitted to Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh; c2013.
  14. Sankar V, Senthilkumar P, Sribalaji N, Nalini P, Arun L, Muralidharan J, *et al.* Effect of Feeding Azolla Meal on Growth Performance of Mecheri Sheep. International Journal of Current Microbiology and Applied Sciences. 2020;9(5):1945-1949.
  15. Sharma NK, Joshi M, Sharma SK. Effect of feeding green Azolla (*Azolla pinnata*) on growth performance in Sirohi male Kids. International Journal of Livestock Research. 2021;11(4):56-62.
  16. Shekh MA, Parnerkar S, Islam MM, Wadhvani KN. Feedlot performance of weaner lambs on conventional and non-conventional total mixed ration. International journal of Science, Environment and Technology. 2016;5(5):3362-3368.
  17. Sinha BS, Kumar S, Chudhary GK. Use of Fresh Azolla as Dietary Supplementation in Backyard Poultry. International Journal of Current Microbiology and Applied Sciences. 2018;7S:1358-1361.
  18. Snedecor GW, Cochran WG. Statistical Methods 8th edition. The Iowa State University Press, Ames, Iowa. U.S.A; c1994.
  19. Toradmal SD, Shelke RR, Kahate PA, Bidwe KU. Studies on supplementation of green Azolla (*Azolla pinnata*) on growth performance of Osmanabadi goat kids. Asian Journal of Animal Science. 2017;12(2):124-128.
  20. Wadhvani KN, Parnerkar S, Saiyed LH, Patel AM. Feedlot performance of weaner lambs on conventional and non-conventional total mixed ration. Indian Journal of Animal Research. 2010;44(1):16-21.