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A STUDY ON ECONOMICS OF INCLUSION OF AZOLLA (*AZOLLAPINNATA*) IN RABBIT RATIONS

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Abstract:The present study was undertaken to evaluate the cost economics of inclusion of azolla in the diet of rabbits. *Azollapinnata* was included in the rabbit rations as a replacement to conventional protein at 0, 10 and 20 per cent levels in T_1, T_2 and T_3 rations, respectively. The study was conducted on 24 Newzealand white rabbits of 30 days old having similar body weights divided into 3 groups with 8 rabbits in each group for a period of 90 days. The unit cost of fresh azolla produced was Rs.0.66 and dry azolla was Rs.6.65. The cost of conventional concentrate ration and the expenditure of azolla cultivation were considered for the calculation of feed cost per kg body weight gain. Mean daily feed intake recorded was 52.28 ± 2.35, 53.14 ± 1.59 and 46.91 ± 1.24 g in rabbits fed with T_1, T_2 and T_3 rations, respectively. The cost of feed per day per rabbit was comparatively higher in T_1 group (Rs.1.12 ± 0.04) followed by T_2 (Rs.1.08 ± 0.02) and T_3 (Rs.0.88 ± 0.02) groups. The cost per kg gain was significantly lower in rabbits fed with T_2 ration (Rs.86.94) than in rabbits fed with T_1 (Rs.106.27) and T_3 (Rs.119.67) rations.
Keywords: Azolla, Newzealand white, Rabbit rations, Cost economics.

Introduction

Rabbit farming though a recent venture in India, has a promising scope for meat production in order to meet the growing global demand for quality animal protein. Despite of the beneficial attributes of rabbits, rabbit production has not yet become major segment of animal husbandry in our country due to lack of technical know-how, high prices of commercial rabbit feed and unorganised market for rabbit meat. About 72 per cent of the rabbit entrepreneurs reported that the feed prices were quite high when compared to output prices (Ashok kumar*et al.,*2010). Protein is the most important component in the diet, which commonly depends on the traditional sources of protein such as soybean meal, groundnut cake and cotton seed cake and the high cost of the conventional plant protein source pose a major problem. In order to make rabbit rearing more profitable as a small scale enterprise, there is a need for the development of cheap sources of feed as an alternative to replace or supplement cereal or other protein sources in the diet of rabbits. Various locally available low

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cost protein sources such as moringa leaf meal were assessed in the past for reducing the feed cost.

Azolla is one of the locally available aquatic pteridophyte which is a good source of protein and almost all essential amino acids. Utilization of azolla was already enlightened in broiler chicken (Balaji *et al.,*2009), laying hens (Alalade *et al.,*2007), buffalo calves (Indira *et al.,*2009), pigs (Cherryl *et al.,*2013) and rabbits (Anitha *et al.,*2016). However, information on its utilization in meat type rabbits is scanty. Hence, the present study was undertaken to explore the viability and economic feasibility of azolla as a partial protein feed replacement in rabbit diets.

Materials and Methods

The present work was undertaken at the Rabbitry unit of Instructional Livestock Farm Complex atCollege of Veterinary Science, Proddatur, Kadapa district in Andhra Pradesh.

Azolla was cultivated in two rectangular pits of dimensions 5m x 4m with a depth of 0.3m.Silpaulinesheets of 24ft x 18ft were spread out over the pits and a layer (10 – 15 cm) of soft soil was spread evenly over the sheet such that no large stones or any other contaminants existed. Water was filled to three fourth level in each pit and regular care was taken to maintain the water up to same level. About 15kg of fresh buffalo dung was dissolved in 35lt of water and was added into each pit with thorough mixing such that the mixture was spread evenly throughout the area. About 30g of super phosphate dissolved in 10lt of water was added to the soil in zigzag manner. Each pit was inoculated with 5kg fresh and pure culture of azolla and water was sprinkled over it. Fully grown azolla was harvested at the end of week and was washed thoroughly in clean water, weighed and sun-dried for 2 to 3 days such that it becomes crispy while green colour is still retained in the dried azolla. The experiment was conducted in 24 Newzealand white rabbits divided into three groups (T_1, T_2 and T_3) with 8 rabbits in each group for 90 days. Conventional concentrate ration with CP 16% was formulated using maize, soybean meal, deoiled rice bran, molasses, mineral mixture, salt, lysine and limestone to cover the nutrient requirements of rabbits according to NRC, 1977 recommendations. Three rations T_1 (conventional ration), T_2 and T_3 were prepared and fed after incorporation of sundried azolla as a protein replacement at 10 per cent in T_2 (900g of conventional ration + 74.41g of sundried azolla) and 20 per cent level inT_3 (800g of conventional ration + 148.82g of sundried azolla). The diets were compounded in mash form and fortified with vitamins and mineral supplements. Feeding was done thrice daily at 8.00AM, 1.00 PM and 6.00 PM. The concentrate ration and the required quantity of azolla to

be fed were weighed and mixed thoroughly and fed accordingly. The daily feed left over was weighed daily and deducted from the feed supplied to know the amount of feed intake per day. Body weights of all the 24 rabbits were recorded every week on Monday before offering the morning feed to study the growth rates. The data were subjected to standard statistical procedures (Snedecor and Cochran, 1994) to arrive at the meaning full conclusions.

Results and Discussion

Azolla was harvested daily and at the end of the week the yield of azolla biomass was 54.2 and 54.5kg from the first and second pit of $20m^2$ each, respectively. Thus the average yield per day was 0.38kg per m^2 from each pit. The total yield obtained from the first and second pit was, 108.4 and 109kg, respectively on fresh basis which was then sundried and stored at room temperature for further use during the experiment.

Perusal of the Table1 revealed that the total capital expenditure required for azolla production from single pit of $20m^2$ was Rs.1058.00 and the recurring expenditure which included the cost inputs viz., dung, super phosphate and mineral mixture was Rs.35.96 for a week. The cost of azolla produced was calculated based on the recurring expenses like cost of inputs used, labour charges and yield of azolla biomass.As per the results in this study it was concluded that the unit cost of fresh azolla production was Rs.0.66 which was higher when compared to Rs.0.65 and Rs.0.56 as reported by Pillai *et al.,*(2002) and Cherryl*et al.* (2013), respectively. The unit cost of sun dried azolla was found to be Rs.6.65 which was slightly higher when compared to Rs.5.65 as reported by Cherryl*et al.*(2013). This may be due to the price variation of inputs used and the prevailing labour charges in those regions.

The cost per kg conventional concentrate ration was Rs.20 and the unit cost of fresh azolla was calculated to be Rs.0.66 and that of dry azolla was Rs.6.65. Thus the cost of T_1, T_2 and T_3 rations with azolla inclusion as protein replacement at 0, 10 and 20% levels, respectively was presented in Table 2. Cumulative feed intake per rabbit with T_1, T_2 and T_3 rations was 4.75, 4.83 and 4.26kg, respectively. Mean daily feed intake recorded was 52.28, 53.14 and 46.91g in rabbits fed with T_1, T_2 and T_3 rations, respectively. As presented in Table 2 cost of ration per day calculated was Rs. 1.12 ± 0.04, 1.08 ± 0.02 and 0.88 ± 0.02 for T_1, T_2 and T_3, respectively. Further T_1 and T_2 did not differ significantly ($P>0.05$) from each other while the cost of ration was lower in the T_3.The differences in the feed cost per day in this study could be clearly attributed to the lower cost of sun dried azolla that was added (Rs.6.65 per kg). It was evident that the addition of azolla reduced the overall cost of the diets containing azolla

at 10 per cent and 20 per cent levels or it might be attributed to the slightly reduced quantities of feed consumed by rabbits fed with rations containing dried azolla.

However, the cost of ration per Kg gain for T_1, T_2 and T_3 groups were Rs.106.27, 86.94 and 119.67, respectively and was highest in T_3 group and lowest in T_2 group.This observation indicated that use of azolla to replace conventional protein source up to 10 per cent in the diet of rabbits is beneficial in the way of reducing cost of feed per kg gain. Similar inferences were made by Basak *et al.* (2002), Dhumal *et al.* (2009), Shamna *et al.* (2013) and Shoukat Ara *et al.* (2015) in birds and by Beccera *et al.* (1995) and Cherryl *et al.* (2013) in pigs. But no enough literature was found with regard to rabbits.

Table 1. Economics of Azolla Production in a pit (5m x 4m)

S.No	Particulars	Cost	Quantity	Amount (Rs.)
I	Capital Expenditure			
A	Labour charges for bed preparation	125.00 per person	1 person	125.00
B	Cost of silpauline sheet	24.00 per m^2	7.2m x 5.4m	933.00
C	TOTAL			1058.00
II	Recurring expenditure			
A	Buffalo dung @ 15Kg	1.25 per Kg	15Kg	18.75
B	Super phosphate @ 30g	7.00 per Kg	30g	0.21
C	Labour charges one hour per week	17.00 per hour	1 hour	17.00
D	TOTAL			35.96
III	Total Yield			
A	Yield of fresh azolla		54Kg	
B	Unit cost of fresh azolla per Kg			0.66
C	Yield of sundried azolla		5.4Kg	
D	Unit cost of sundried azolla per Kg			6.65

Table 2. Cost economics in rabbits of different treatment groups for 90 days

Particulars	Replacement of conventional protein by azolla protein		
	T_1 (0%)	T_2 (10%)	T3 (20%)
Quantity of concentrate feed (g)	1000.00	900.00	800.00
Cost of concentrate feed (Rs.20 per Kg)	20.00	18.00	16.00
Quantity of azolla (g)	0	74.41	148.82
Cost of azolla (Rs.6.65 per Kg)	0	0.50	0.98
Total feed (Kg)	1.00	0.97	0.94
Total cost of feed per Kg (Rs)	20.00	18.98	17.89
Cumulative feed intake per rabbit (Kg)	4.75	4.83	4.26
Average feed intake per day (g)	52.28	53.14	46.91
Average daily gain during 90 days (g)	11.09	12.54	7.45
Cost of feed per day per rabbit (Rs)	1.12 ± 0.04^a	1.08 ± 0.02^a	0.88 ± 0.02^b
Cost per Kg gain (Rs)	106.27	86.94	119.67

Means with different superscript differ significantly (P<0.01)

Conclusion

Considering the parameters of economic importance, i.e., cost of ration and cost per kg gain, it might be concluded that inclusion of azolla at 10% is not harmful rather it is beneficial, in the way reducing the cost of feed per kg gain. The scope for inclusion of sun dried azolla as an unconventional natural protein feed source in diets of rabbits is feasible up to 10 per cent and recommended without any negative harmful effects. Further proper utilisation of azollain the system needs to be explored through digestibility trials.

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